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The first nuclear war conference, Washington, D.C.

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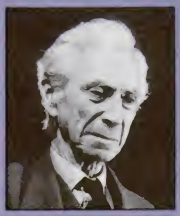
Emily Greene Balch
1946 Nobel Peace
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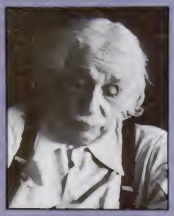
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WHY EINSTEIN'S APPEAL HAS SPECIAL MEANING TO YOU

Just before his death, twenty-three years ago, Albert Einstein along with Bertrand Russell, issued an appeal, raising his voice on an issue that has become even more urgent since his death.

Einstein and Russell outlined the inevitable horrors that would follow the use of nuclear weapons. And they said:





There lies before us, if we choose, continual progress in happiness, knowledge and wisdom. Shall we, instead, choose death, because we cannot forget our quarrels? We appeal, as human beings, to human beings: Remember your humanity and forget the rest. If you can do so, the way lies open to a new paradise; if you cannot, there lies before you the risk of universal death.

In view of the fact that in any future world war nuclear weapons will certainly be employed, and that such weapons threaten the continued existence of mankind, we urge the governments of the world to realize, and to acknowledge publicly, that their purposes cannot be furthered by a world war, and we urge them, consequently, to find peaceful means for the settlement of all matters of dispute between them.*

In 1955 Albert Einstein signed the Einstein-Russell Manifesto calling on men and women to pay attention to the single most urgent problem of our time: the threat of thermonuclear war.

The scientists of both East and West responded to the Appeal of Albert Einstein and Bertrand Russell and the Pugwash Movement was born. For 22 years eminent scientists have met, without publicity, to work toward lessening the danger of thermonuclear war.

Out of these meetings have come the SALT talks, the Partial Test Ban Treaty, and the Non-Proliferation Treaty.

Pugwash now issues an appeal to you. The threat of war is as real and as present as it was 22 years ago.

Pugwash needs your help to carry on its work. You become a very special person, making it possible for one more important contribution to peace to be made. Without your help the budget of Pugwash, easily the most successful peace effort available, must be cut.

Become a friend of Pugwash. Answer its urgent request for funds and so carry on the world begun by Albert Einstein and Bertrand Russell.

*From the Einstein-Russell Manifesto, signed by Max Born, P. W. Bridgman, Albert Einstein, Leopold Infeld, J. F. Joliot-Curie, H. J. Muller, Linus Pauling, C. F. Powell, Joseph Rotblat, Bertrand Russell, Hideki Yukawa, and others.

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Emily Greene Balch (1867-1961) recipient of the Nobel Peace Price in 1946, was born in Boston, Massachusetts in 1867. Professor of economics and sociology at Wellesley College from 1896 until 1913, she resigned teaching to devote herself to peace. A founder of the Women's International League for Peace and Freedom, she campaigned against U.S. participation in World War I. In the 1920s, she worked on behalf of the League of Nations and during the 1930s, she assisted the victims of Nazi persecution. Emily Balch saw in World War II reason to defend human rights by the sword.

1946

It is natural to try to understand one's own time and to seek to analyze the forces that move it. The future will be determined in part by happenings that it is impossible to foresee; it will also be influenced by trends that are now existent and observable. We speculate as to what is in store for us. But we not only undergo events, we in part cause them or at least influence their course. We have not only to study them but to act. Especially is this true as regards peace in the future. The question whether the long effort to put an end to war can succeed without another major convulsion challenges not only our minds but our sense of responsibility. . . .

First let us consider the urge toward liberty. In the shape of revolt from alien domination and of demand for independence this has been a major shaping force in modern history. The desire for liberty has also made itself felt as struggle against domestic tyranny or arbitrary rule.

At the same time, liberty, as a personal ideal, as a revolt against authority in the realm of ideas, has enriched men's minds and strengthened their character and self-dependence. It has been a great current of fresh air quickening the atmosphere. . . .

Democracy is a second ideal widely influential throughout our whole modern world. Doubtless the word has different meanings to different people. We say that to the Russians "democratic" means favorable to the Soviet system and that to the Western peoples it means friendly to the parliamentary form of government. There is nevertheless a basic area of common meaning in spite of the fact that each is concerned with a different aspect of one immensely challenging and difficult ideal. They both mean by a democratic system one which serves the interest of all men alike and not that of privileged persons, and one in which the ultimate power is in the hands of the entire population and wielded in their name, a society in which inequities and inequalities are reduced to a minimum.

A third ideal that has made its way in the modern world is reliance on reason, especially reason disciplined and enriched by modern science. An eternal basis of human intercommunication is reason. It demands honest objectivity, scrupulously clean of any influence except the desire for the truth.

A dark and terrible side of this sense of community of interests is the fear of a horrible common destiny which in these days of atomic weapons darkens men's minds all around the globe. Men have a sense of being subject to the same fate, of being all in the same boat. But fear is a poor motive to which to appeal, and I am sure that "peace people" are on a wrong path when they expatiate on the horrors of a new world war. Fear weakens the nerves and distorts the judgment. It is not by fear that mankind must exorcise the demon of destruction and cruelty, but by motives more reasonable, more humane, and more heroic. . . .

In thinking of trends to unify mankind, we must face squarely, without underrating them, all that tends to the contrary, tends to divide men, to separate and hold them apart, to array them consciously and passionately against one another. Not only democracy and the cult of humaneness mark our age, but also greed, violence, the self-adulation of national and racial groups, the fanaticism of political cults like fascism or nazism, the glorification of might and power for their own sake, the blind reliance on violence as that before which all idealism is but a dissolving mist. All these things we know only too well. . . .

That these clashes of ideals and purposes should take the form of war is, however, intolerable. Indeed in the light of all that mankind has achieved and desired it seems almost incomprehensible that it is today so largely occupied in preparing for war in more hideous forms than ever before. Huge sums of money and treasures of human cleverness and industry are invested in inventing new and more ghastly poisons, methods of disseminating diseases and perfecting instruments of destruction instantaneous and almost unlimited.

The attempt to put an end to war is a special and urgent task which we must solve and solve soon. It is a necessary complement to the forces that are bringing men closer together if these are to prevail over those that divide men into hostile camps.

The ideas that men share and the needs that they all feel, need a suitable organ. They need an institutional body to make them effective. The nation created the national state. The world community must create a political expression for itself.

As the world community develops in peace, it will open up great untapped reservoirs in human nature. Like a spring released from pressure would be the response of a generation of young men and women growing up in an atmosphere of friendliness and security, in a world demanding their service, offering them comradeship, calling to all adventurous and forward reaching natures.

EMILY GREENE BALCH
Nobel Lecture
April 7, 1948
Oslo, Norway

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The first nuclear war conference

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This One
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BERNARD T. FELD

The uneasy triangle

As long-time advocates of U.S. recognition of the People's Republic of China, we have been pleased to observe the rapid strides in the normalization of our relations, most recently advanced by the whirlwind visit of the ubiquitous Teng Hsiao-ping (or Deng Xiaoping in the now-official Pinyin system). We are greatly attracted to the vice-premier's pragmatic attitude toward problems of Chinese modernization. And we are impressed with his reasonable approach to the eventual resolution of the "two-Chinas" issue. However, this only serves to heighten our disappointment with the cavalier attitude of the Chinese leaders toward the use of naked military force for expressing irritation over the behavior of their Vietnamese neighbor. Neither can we comprehend the apparent inability of the People's Republic to understand the importance of the success of SALT II.

The insistence of the Chinese on holding the survival of the Western world hostage to Soviet acceptance of our rules of political 'good' behavior is something that our Chinese friends seem to share with the leadership of the U.S. Republican Party. Yet, even accepting the deep-seated nature of the Sino-Soviet antagonism, it is tragic that the Chinese leadership refuses to understand how essential it is to avoid a nuclear war. This is especially true now that China has recognized the advantages of drawing support from Western technology for rapid modernization. Nuclear war would abolish—without hope of retrieval—the Western technological base upon which the new leadership is now staking China's future.

SALT is a *sine qua non* for the avoidance of nuclear war.

In Southeast Asia, the current Sino-Soviet competition is but another tragedy for the populations involved in such conflicts. The Soviet-encouraged power play of Vietnam bodes ill for future stability in the Indo-Chinese region. And yet, unquestioning support by the Chinese for the murderous Pol Pot regime in Cambodia is unconscionable. In the circumstance, the even-handed approach of the Carter administration is to be commended. If the United States still has any role to play in the region, it is one of supporting moderate, humane and independent regimes for the long-suffering countries of that area as well as one of encouraging the disengagement of the Russian bear and the Chinese dragon in Asia. But beyond our general concern for peace in the Third World, there are the immediate and grave dangers that a war, involving any of the major powers, could too easily spread into a global nuclear conflagration. These frightening prospects were the subject of a Conference on Nuclear War, held in Washington, D.C., last December 7. The first installment of a report from that Conference appears in this issue of the *Bulletin*.

In the context of all these concerns it is of interest to recall some comments of my predecessor, the late Eugene Rabinowitch, made just eight years ago in this column.

"Over the quarter-century that has passed since the end of World War II, we have been faced with the danger of nations stumbling into a nuclear war because of inadequate understanding of its consequences—in other words, because of the extension of traditional concepts of weapons superiority and military victory into the nuclear age. This danger has abated, even if it is by no means permanently eliminated.

Among nuclear nations, only China still professes to believe that another major war is inevitable, that it will lead to worldwide triumph of communism in its Chinese interpretation and that in the wake of this victory, mankind will enter an era of unprecedented progress. Whether the Chinese leaders really believe in this wishful dream, or merely find it probable to pretend that they do so, we don't know.

But even if the Chinese ultimately join the rest of the world in understanding that a major war has ceased to be a rational means for attaining political aims, this will not be enough. Something more than universal paralysis of fear is needed to make mankind truly viable in the age of the scientific revolution.

Passive, grudging 'co-existence,' in continued mutual isolation, can be only a first step away from the old pattern of international behavior, made obsolete by science and technology. A valid, constructive alternative to power politics must be evolved. This alternative cannot lie in mere 'co-existence,' but only in active collaboration of all nations, in cooperative utilization of the vast powers given to mankind by science for the common benefit of all. . . .

It seems to me that we should aim at something more imaginative than mere day-by-day maintenance of a tenuous armistice. Scientists must be aware, more deeply and more clearly than their societies at large, of the radical change the scientific revolution has brought into human affairs. They know that a new chapter of

history must be opened if history is not to end. We must work not for armistice, but for peace.

The scientific revolution, while providing organized societies with unbelievably powerful tools of mutual destruction, also endows them with unprecedented capacity for creation of new wealth. To make full use of these powers, nations must make a choice, giving priority to common constructive purposes over continued pursuit of divisive, self-centered interests. They are yet far from making this choice, even if facts of human existence in the age of science urge it on them.

Not so long ago, realistic politicians could argue that a strong military shield was a necessary price to pay for healthy economic progress. The economic growth of Bismarck's Germany after the Franco-Prussian War was a good example. But since then, the cost of military preparedness has gone up by many orders of magnitude, while the possibility of shielding a nation from destruction in case of war has gone down and down, until the very word 'security' has become a mockery.

The rise of the two losers in World War II, Germany and Japan, has shown that prosperity does not require domination over extensive territories or possession of vast natural resources and military power to secure them. Rather, it requires intelligent application of science and technology.

These realities of the international situation are making continuation of traditional power politics between nations not only intolerably expensive and incredibly dangerous, but also barren of real success. As scientists, we are aware of this situation and must use all our influence to make nations understand it and devise their policies accordingly. . . .

Now the human habitat is being changed by the scientific revolution. This change has two main aspects: first, continuation of armed competition between self-centered societies has become deadly dangerous and self-defeating; and second, wealth available to man has ceased to be limited. 'Synthetic,' man-made wealth is increasingly supplementing natural wealth. This new type of wealth is not an object of competition, of a zero-sum game; it is something that all can utilize at the same time, a game in which everybody can win.

These changes alter radically the international situation. Instead of prime consideration of every nation being advancement of its separate, competitive interests, the prime rational aims of all nations are now the common goals of world security and world prosperity—aims that can be best approached by a cooperative effort. . . .

What was once valid for a single society—united we stand, divided we fall!—is becoming true of mankind as a whole.

This is why I believe that in addition to continuing work on maintaining and strengthening the armistice between East and West, there is an even more creative role for scientists to play—that of exploring and implementing constructive cooperation among the groups into which mankind is now divided.

There are two areas in which such constructive cooperation among scientists of all countries is most urgent if man is to surmount the challenges of the scientific revolution. The first challenge is to narrow the gap between the rich and the poor nations: roughly one-third of the world population in the van of the technological progress, and about two-thirds living in pre-scientific conditions. This situation is inherently unstable, particularly since a population explosion has been unleashed by the introduction of elementary hygiene into childbirth and child rearing. The second immediate challenge is preservation and restoration of a healthy habitat, presently endangered by unthinking pursuit of industrialization. This task, too, is made much more difficult by the rapid population growth.

A proper function of concerned scientists is to mobilize the scientific communities—East and West, North and South—for exploration of these challenges and cooperative efforts to deal with them. . . .

Scientists everywhere must see the possible failure of technological civilization with horror. Science has created the concept of progress. It has replaced the ideal of a past golden age with belief in a golden age of the future. It has extended biological evolution, which led from primitive microorganisms to highly complex animals, with homo sapiens at its apex, into cultural and social evolution of society towards ever-growing and ever-spreading knowledge, power and prosperity.

Science is the child of the human brain. Rational response to the threat of chaos—a chaos arising from resistance to rational change of traditional attitudes of individuals and traditional institutions of society, is the scientists' case par excellence."□

From Washington

WILLARD C. MATTHIAS

Preview: the Soviet experts and SALT

As the debate on SALT II gets underway, the American public will be treated to a confusing phenomenon. There will be experts on Soviet affairs—scholars, former diplomats, retired generals and admirals, and ex-intelligence officers—who will differ sharply with each other. At one extreme will be a group who believes the Soviets are evil men dedicated to the destruction or enslavement of the United States and its allies. At the other extreme will be those who believe the Soviets are fearful of the United States and dedicated to the peaceful development of their country. And there will be various gradations of views in between the extremes. Why will so many so-called experts differ so sharply?

One reason is that the questions we ask of ourselves and of our Soviet experts cannot be easily answered. For example, "What kind of people are they really, and what do they want?" is a debatable question. But the Soviets must also ask the same questions about us.

What kind of people are we, when we elect as president a man who made a political career out of anti-communism and then initiated a policy of détente?

What kind of people are we, when we then reelect him with a large majority and drive him from office less than two years later?

What kind of people are we when we substitute a Columbia University professor born in Poland for a Harvard professor born in Germany and with the substitution get a national security advisor to the president who looks as if he is undermining the policy of his predecessor?

What kind of people are we when many conservatives seek to relax tensions with Russia and many liberals seek to heighten them?

Paradoxes abound in American policy and behavior as well as in Soviet policy and behavior. These paradoxes are not easy to resolve. Much depends upon what history, what evidence, what individuals, what theories and explanations one chooses to take into account.

One reason the experts differ is because their experiences have been different and because they have formed hypotheses to which they have become emotionally and intellectually attached. It will be easy to observe these advocates and then characterize them irresponsibly with such epithets as "old time liberal" or "old Cold Warrior." But most will be honorable men who believe that they have studied the subject and considered the issues carefully.

Are there any guidelines to help the public and its elected representatives judge what they are being told? Probably none that are definitive. But the cause is not hopeless. Here are a few thoughts that might help.

• Some experts will be retired military officers of high rank who have given this nation many years of dedicated service. They are men who have had terrible responsibilities; they have been charged with being prepared to deliver the most terrifying weapons in human history upon the people of another nation. They have been obliged to think of the Soviet Union as the potential enemy; it was easier to do this if they looked upon the Soviets as evil men aiming to destroy us one way or another. Not all military leaders, of course, have followed this avenue toward personal self-respect. But some did and—in retirement—have adhered to the same prescription.

• Some will be former government officials whose formative years, both as students and officials, were during the excesses and atrocities of the Stalinist period. They were right then to have thought of that Soviet leader as an evil man. But there has also been a political revolution of major proportions in the Soviet Union since Stalin's death, which has altered many aspects of Soviet ideology and behavior. Not all of those whose ideas were formed during the Stalinist period have comprehended the things that have happened since. It will be important to distinguish those who have from those who have not.

• Many of the "experts" who will testify will be specialists in the mathematics of destruction, a major industry in this country and a major preoccupation of many Pentagon officials. The country will be barraged with statistical data on throw-weights, CEPs, kill probabilities, and much more. The impact of all this will be to suggest that the decision regarding SALT should be made on the basis of complex statistical calculations which only the "expert" can understand. What will get lost or obfuscated will be the simple fact that both sides already have more than enough nuclear weapons to kill each other off anyway. It will be important not to let the statisticians get control of the debate.



Willard C. Matthias, who was a member of the Board of National Estimates at the Central Intelligence Agency for 12 years, is now research director of the American Committee on East-West Accord.

• Patriotism and anti-communism —not the same thing—will get a big play among self-proclaimed experts who write newspaper editorials and make senatorial speeches for the record. It ought to be made clear at the outset what will be undeniably true, namely, that all sides on the debate will be patriots and none desirous of replicating the Soviet political system here or elsewhere. The issue again will be quite simple: will the SALT agreement help or hurt the stabilization of mutual deterrence? It will not be a question of love of country or love of Russia; it will be a question of what happens in the arms race if we do not have SALT.

• There will be other so-called experts who will try to link arms control with the health of détente. They will rehearse Soviet behavior over the past few years and suggest that arms control agreements should not be ratified because détente has "failed," and so forth. But arms control and détente are not dependent one upon the other; arms control has justifications of its own. The sole question should be whether SALT II can justify itself, not whether it is justified by détente.

No doubt the debate on SALT will be confusing to many Americans, so confusing perhaps that there will be a strong urge to shrug one's shoulders and leave it up to the senators to sort myth from reality. But, while some senators are already committed one way or the other on SALT ratification, there is also a large "center" made up of senators who want to keep an open mind. They, like the public, will find it difficult to wade through the mass of fact, opinion, and misinformation which will flood the press and the airways, to say nothing of the senatorial mail.

If there is a way out it is to try to reduce the issue to a few simple questions and not to get lost in a maze of charts, emotion, and an excess of expertise.□

WILLIAM EPSTEIN

Banning the use of nuclear weapons

The first official proposal to ban the use of nuclear weapons was made by Andrei Gromyko, then Ambassador of the Soviet Union, before the U.N. Atomic Energy Commission in June 1946. It was a part of the Soviet response to the American plan proposed by Bernard Baruch a few days earlier for the international control of atomic energy.

The Soviet proposal was rejected, as were numerous other similar ones submitted by the Soviet Union over the next three decades, including a draft convention to prohibit the use of nuclear weapons. On several occasions, however, the General Assembly urged all states to examine the question and to undertake negotiations concerning the conclusion of an appropriate convention.

In 1972, the General Assembly adopted a Soviet draft resolution (No. 2936 XXVII), which "solemnly declares . . . the renunciation of the use or threat of force . . . in accordance with the U.N. Charter and the permanent prohibition of the use of nuclear weapons." The vote was 73 in favor to 4 against (including China), with 46 abstentions (including the United States, United Kingdom and France). Some of the abstaining countries considered that linking the non-use of force to the non-use of nuclear weapons tended to dilute and weaken the latter prohibition, but the NATO countries were in any case opposed to a simple declaratory prohibition of the use of nuclear weapons.

In 1961, however, the General Assembly adopted what came to be known as the Ethiopian resolution (No. 1653 XVI) which declared that "Any state using nuclear and thermonuclear weapons is to be considered as violating the Charter of the United Nations, as acting contrary to the laws of humanity and as committing a crime against mankind and civilization." The resolution was adopted by 55 votes in favor to 20 against, with 26 abstentions. (At that time the U.N. had 103 members.) The USSR and the Warsaw Treaty powers voted for the resolution; the USA and the NATO powers voted against. All efforts based on the resolution to convene a conference to sign a convention to prohibit the use of nuclear weapons came to naught.

Ever since it exploded its first atomic bomb in 1964, China has maintained that it would never be the first to use nuclear weapons.

In October 1977, President Carter in the General Assembly pledged that "the United States will not use nuclear weapons except in self-defense; that is, in circumstances of an actual nuclear or conventional attack on the United States, our territories or armed forces, or of such an attack on our allies." The pledge was repeated by Vice-President Mondale at the recent U.N. Special Session on Disarmament. This commitment against use permits the use of nuclear weapons in response to a conventional attack by either a nuclear or non-nuclear power.

President Leonid Brezhnev went somewhat further when he stated on April 25, 1978 (and Foreign Minister Gromyko repeated at the Special Session) that the Soviet Union was

"against the use of nuclear weapons; only extraordinary circumstances—aggression against our country or its allies by another nuclear power—could compel us to resort to this extreme means of self-defense."

Thus the Soviet Union, like the United States, reserved the right of first-use of nuclear weapons even in



William Epstein is a Special Fellow of the United Nations Institute for Training and Research. He was a member of the Canadian Delegation to the U.N. Special Session on Disarmament and to the 33rd regular session of the General Assembly. This article expresses his personal views and not necessarily those of the Canadian Delegation. He is the author of *The Last Chance: Nuclear Proliferation and Arms Control* (1976).

response to a conventional attack, but only if the attacker was a nuclear power.

In a draft resolution circulated at the Special Session on Disarmament in June 1978, India revived the basic declaration of the 1961 Ethiopian resolution declaring the use of nuclear weapons "a violation of the U.N. Charter and a crime against humanity." It also called for an international convention to prohibit the use of nuclear weapons.

The Indian resolution was not pressed to a vote at the Special Session since it had been agreed that decisions there would be taken by consensus. India, however, reintroduced the draft resolution at the 33rd annual regular session of the General Assembly in the fall of 1978. It was adopted by an overwhelming majority of 103 votes in favor, 18 against, and 18 abstentions. The United States and all its NATO allies voted "no"; the Soviet Union and its socialist allies, in a departure from their vote on the Ethiopian resolution 17 years earlier, abstained; China did not participate.

It seems clear from the overwhelming vote in favor of the resolution, compared with that on the Ethiopian resolution, with the affirmative votes almost doubling and the negative votes and abstentions reduced from 46 to 36, that sentiment in the world, at least as registered by votes of Member States of the United Nations, is moving against the use of nuclear weapons.

While an Assembly resolution is not legally binding on the member states, it does of course have both political and moral weight and adds to the development of international law on the subject.

Non-use against Non-nuclear States. Among the nuclear powers, only China has clearly and unequivocally declared that it would never use nuclear weapons against any non-nuclear states. The other nuclear powers have persistently refused to make such statements despite strong pressure from the non-nuclear states.

At the Special Session, however, some progress was made. The Soviet Union announced that it had signed Protocol II of the Treaty of Tlatelolco by which it undertook to respect the status of the zone and not to use nuclear weapons against any country that was a member of the Latin-American nuclear-free zone. It also declared that it would "never use nuclear weapons against those states which renounce the production and acquisition of such weapons and do not have them on their territories." It also announced that it was prepared to enter into bilateral agreements to that effect with any such non-nuclear states.[2]

The United States and the United Kingdom gave more limited undertakings. The U. S. declaration was:

"The United States will not use nuclear weapons against any non-nuclear-weapon State party to the Non-Proliferation Treaty or to any comparable internationally binding commitment not to acquire nuclear explosive devices, except in the case of an attack on the United States, its territories or armed forces or its allies by such a State allied to a nuclear-weapon State or associated with a nuclear-weapon State in carrying out or sustaining the attack."

The U. K. declaration, which was similar to the American, was as follows:

"I accordingly give the following assurance, on behalf of my Government, to non-nuclear-weapon States which are parties to the Non-Proliferation Treaty or to other internationally binding commitments not to manufacture or acquire nuclear explosive devices: Britain undertakes not to use nuclear weapons against such States except in the case of an attack on the United Kingdom, its dependent territories, its armed forces or its allies by such a State in association or alliance with a nuclear-weapon State."

All three pledges were designed to encourage non-nuclear states to adhere to or abide by the provisions of the Non-Proliferation Treaty. Some of the non-nuclear states felt that the U. S. and U. K. declarations were discriminating against non-nuclear states that were not parties to the NPT but which had no nuclear weapons on their territories.

France made an even more restricted pledge. It supported a ban on the use or threat of use of nuclear weapons against states that are part



of a nuclear-free zone, and declared that it was prepared to enter into contractual agreements with such zones for binding commitments.

These various undertakings by the four nuclear powers are somewhat hedged and inadequate, but they are some indication that the nuclear powers were at least becoming conscious of the need to provide security assurances to states that forego the right to acquire nuclear weapons.

At the 33rd regular session of the General Assembly, the Soviet Union took a new initiative. It proposed the elaboration of a convention on strengthening guarantees of the security of non-nuclear states, whereby the nuclear weapon states would pledge not to use or threaten to use nuclear weapons against non-nuclear states which renounce the production and acquisition of nuclear weapons and which have no nuclear weapons in their territory or anywhere under their jurisdiction or control. Pakistan proposed a counter-draft convention whereby the nuclear weapon states would pledge not to use or threaten to use nuclear weapons against non-nuclear weapon states not parties to the nuclear security arrangements of some nuclear weapon states, and whereby the nuclear weapon states would undertake to achieve the complete elimination of nuclear weapons in the shortest possible time.

The United States and its NATO allies were opposed to both proposals. The United States contented itself with suggesting that the Security Council merely endorse the limited pledges made by the three nuclear powers at the Special Session in the spring. It did not, however, press this suggestion to a vote; had it done so, its proposal would in all likelihood have been rejected.

In order to avoid a bruising showdown, the Soviet Union and Pakistan agreed to a compromise. Both revised their draft resolutions to request that the Committee on Disarmament consider all the proposals made, without assigning priority to any. Both resolutions were adopted by overwhelming majorities with the United States voting in favor of the Soviet draft. China voted against the Soviet resolution and France abstained. Both China and France voted for the Pakistani resolution, but the United States and the Soviet Union abstained.

Non-First-Use of Nuclear Weapons. No proposals were made for declarations or conventions of non-first-use of nuclear weapons. Such a commitment would, at least from the legal point of view, have the same effect as the outlawing of chemical and bacteriological weapons by the Geneva Protocol of 1925. For practical purposes, it would have much the same effect as a complete ban on the use of nuclear weapons. If no nuclear power would be the first to use nuclear weapons, then obviously they could never be used against any non-nuclear country, nor, if the pledge were honored by *all* the nuclear powers, would they ever be used against any nuclear power.

There is no reason, however, for thinking that a proposal for no-first-use would in the present climate of international relations have any more chance of achieving success than the proposals actually put forward. It took more than ten years to obtain commitments from all five nuclear powers not to use or threaten to use nuclear weapons against the countries that are members of the Latin-American nuclear-free zone. Any broader binding undertakings are obviously a long time away.

In the meantime we can expect the non-nuclear countries, in particular those that are not allied to the nuclear weapon powers in the NATO and Warsaw alliances, with the support of China, to keep pressing for: (1) declarations of non-use of nuclear weapons against non-nuclear states; (2) declarations of non-first-use of such weapons; and (3) an absolute ban on the use of such weapons under any circumstances.□

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Two seemingly contradictory themes have been evident in Soviet strategic policy during the last two decades. A political scientist examines some of the problems involved in analyzing and assessing current behavior.

WILLIAM D. JACKSON

Policy assessment at the crossroads: the Soviets and SALT

Debate over the SALT II agreement in the coming months is likely to bring to the center of public attention profound differences of opinion regarding the nature and objectives of Soviet strategic policy. Underlying such differences among military analysts and Soviet specialists, as well as many of the key makers and influencers of U.S. strategic policy, is the fact that during the last two decades two seemingly contradictory themes have been evident in Soviet strategic policy.

On the one hand, Soviet leaders, Brezhnev no less than Khrushchev, have repeatedly affirmed the Soviet Union's commitment to curbing the nuclear arms race. On the other, Soviet leadership has continued to strengthen the strategic might of the Soviet Union, supplying Soviet forces with capabilities which, in the view of some U.S. policy-makers, seriously compromise the U.S. deterrent. Just how these dual concerns—curbing the arms race and developing strategic power—are related and which theme is dominant have for some time been a matter of controversy in the West.

In general, analyses of Soviet strategic conduct reflect a wide variety of assumptions and conclusions. While some view Soviet behavior in the nuclear arms competition as part of an action-reaction dynamic for which Moscow shares less blame than Washington, others presume that the ideological world view inherent to communism or sheer imperial ambitions dispose the Soviets to seek a position of dominance in the strategic competition. The former often assume that greater U.S. restraint will beget greater Soviet restraint; the latter often imply that the Soviets view SALT less as a means of curbing the arms race and enhancing strategic stability than as a diplomatic tactic designed to slow U.S. programs and facilitate the realization of Soviet gains in the political and military balance.[1]

Other analyses of Moscow's behavior in the nuclear competition stress the impact of history on Soviet conduct. The effect of history—recent and ancient—on Soviet behavior is itself a matter of disagreement, however. Thus some studies suggest that Russia, as a historically insecure society, has always had a predisposition to the maintenance of large military forces. The West, it is implied, should not be overalarmed by Moscow's continuing military effort since such behavior is essentially defensive and stems from insecurities rooted in past history rather than current aggressive designs.[2] Still others suggest that Russia is by nature a bellicose society and that its leaders, calloused by Russia's violent past, are preparing to fight and win a nuclear war to achieve their political aims.[3]

A further controversy concerns the images or models of the Soviet political system appropriate to the analysis of the policy-making process. While some analyses of Soviet military policy rest on an image of a political system dominated by a monolithic party leadership, others are based on images which dispute this unity, its control over policy, or both. The latter often posit a limited pluralism in the Soviet system and assign varying degrees of influence to hawks and doves. Some studies discern the working of a powerful military-industrial complex in the Soviet Union or the uncontrolled momentum of weapons technology;[4] others reject a concept of the military-industrial complex as applied to the Soviet Union and posit important differences between the nature of the weapons development processes and the impact of the military as an interest group in capitalist and socialist societies.[5]

Although the ultimate sources of Soviet behavior in the nuclear arms competition and the nature of Soviet policy are likely to remain controversial, the recent record contains important evidence of both the seriousness of Moscow's interest in restricting the strategic competition and the willingness of the Soviet Union to be a formidable competitor in the nuclear arms race. These two faces of Soviet strategic conduct will be examined more closely below.

* * *

In the recent debate over Soviet strategic intentions, history is cited to support competing truths. Both those who argue that restraint will beget restraint in the strategic competition and those who argue that the Soviets view SALT as a political tactic designed to achieve strategic superiority claim to find confirmation for their views in the recent record of Soviet conduct. The decade since 1969 has been one of unprecedented progress in U.S.-Soviet negotiations on strategic arms control; yet it has also been a period of extraordinary growth in Soviet strategic power. It will be suggested here, however, that despite this continued growth the record of Soviet conduct offers some cause for optimism regarding Moscow's desire to limit strategic competition.

The Soviet Record in SALT. Following a series of evasive replies to overtures from the Johnson administration in 1965 and 1966 to begin U.S.-Soviet talks on strategic arms, Moscow notified Washington in May 1967 that it was prepared in



principle to participate in U.S.-Soviet discussions on "means of limiting the arms race in offensive and defensive nuclear missiles."[6] Several considerations appeared to sharpen Soviet interest in SALT.

Moscow's decision to enter SALT was made in the context of an ongoing Soviet strategic effort which was rapidly eliminating the Soviet inferiority in the nuclear missile balance which had existed since 1960. Since 1965 the Soviets had been adding over 250 second-generation ICBMs annually to their strategic arsenal. By 1968 Moscow had deployed 850 ICBMs and in late 1969 or 1970 the Soviet land-based missile force was expected to surpass the U.S. arsenal in number—if not in certain dimensions of performance. Yankee class missile-firing submarines were entering service at a rate comparable to that at which the U.S. had deployed Polaris in the early 1960s.

While there was reason for growing satisfaction with the strategic balance in Moscow, and such satisfaction was in fact evident in the statements of military and civilian leaders, there was also by 1967 reason for anxieties regarding the uncertain future of the strategic arms competition. MIRV and ABM programs underway in the United States in early 1967 appear to have been viewed in Moscow with real concern. MIRV threatened to undercut recent Soviet gains in the strategic balance, and to increase sharply the vulnerability of the Soviet arsenal to U.S. attack. While Moscow did not view ABM as destabilizing *per se*, the Soviet ABM program had encountered technical difficulties by 1967, and concern probably existed in Moscow that the Soviet Union could not match the United States in an ABM race. In addition to such immediate military concerns, political considerations probably weighed heavily in Moscow's decision to begin SALT. A new round in the arms race would exacerbate East-West relations at a time when relations were worsening with the Chinese and when Moscow was engulfed in a diplomatic campaign to improve relations with Western Europe and secure the application of the Non-Proliferation Treaty to Germany.

Underlying these particular motivations, there clearly existed in Moscow a more generalized concern with the dangers of nuclear war, accidental or deliberate. After 1956, Khrushchev openly rejected the view dominant under Stalin that nuclear weapons did not change the nature of war or the role of war in history. He stressed increasingly the calamitous nature of nuclear war and the imperative of nuclear war avoidance in his speeches to Party audiences. Like Khrushchev, Brezhnev, in his speeches to the Party and the nation, has advanced grim descriptions of nuclear war as a catastrophe "entailing hundreds of millions of deaths" and "the mass annihilation of peoples."[7]

Increasingly dire images of nuclear war have appeared as well in authoritative military writings. The third edition of Marshal Sokolovsky's text on military strategy notes:

"The losses in a world nuclear war will not only be suffered by the USA and their NATO allies, but also by the socialist countries. The logic of a world nuclear war is such that in the sphere of its effect would fall an overwhelming majority of the world's states. As a result of a war many hundreds of millions of people would perish, and most of those remaining alive, in one respect or another would be subject to radioactive contamination."[8]

By entering SALT, Moscow probably hoped to reduce pressure in the West for new arms programs, buttress its non-proliferation campaign, improve the overall political climate with the West, and secure recognition of the improved Soviet position in the nuclear balance. In securing these objectives, however, the leadership in Moscow also generally sought to mitigate the danger of nuclear war.

Nearly a decade of SALT has revealed much about both the Soviet approach to strategic arms and the nature of Soviet interests in arms limitations. In general, Moscow's behavior in SALT has been guided by practical concerns with the nuclear balance rather than by a general commitment to abstract principles of deterrence theory. In the Soviet view, the last decade's improvement in the strategic balance has reduced the threat of nuclear war as well as the danger of nuclear blackmail by the United States.[9] Through SALT, Moscow has sought to limit those programs which threaten to confer new U.S. strategic advantages and which reduce the Soviet ability to strike the United States. To achieve progress toward these objectives, however, the Soviets have been willing to make concessions which impose significant limits on their own strategic programs. Overall, the Soviet record in SALT offers evidence that Moscow places a high value on the restriction of strategic competition.

In the opening months of SALT I, the Soviets sought to define strategic systems to include forward-based



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nuclear systems (FBS) stationed in Europe and capable of striking the Soviet Union. They also sought to ban MIRV production and deployment and rejected a U.S. proposal which would limit the deployment of heavy Soviet ICBMs. Subsequently, in the SALT I negotiations, Moscow abandoned its demand regarding the inclusion of FBS (some compensation for U.S. nuclear systems in Europe was still sought, however), and accepted a sublimit on heavy missiles of the SS-9 class. Although SS-9 deployment had leveled off below 300 in 1970 and Moscow may not have envisioned an SS-9 heavy missile force in excess of the limit of 313 imposed by SALT I, Moscow's acceptance of the principle of limitations on the size of the missiles it deployed was a significant step which probably provoked some internal opposition within the military. Signs of military dissatisfaction with the decision to omit FBS from SALT I were clearly apparent. In the months preceding the conclusion of SALT I, Soviet military spokesmen continued to stress the danger posed by the "more than 7,000 U.S. nuclear weapons in Europe" capable of striking the Soviet homeland, long after Brezhnev had ceased to emphasize the threat of such systems.[10]

By the spring of 1972 Moscow had apparently decided that the value of a SALT agreement which limited ABM, froze the strategic missile balance for five years and symbolized new cooperation in East-West relations was worth the costs of yielding not only on FBS, but also on the sublimit on heavy missiles and MIRV limitation. To Moscow, SALT I was also worth the political costs of improving relations with Washington, while Washington was escalating the war against a Soviet ally. The conclusion of SALT I appears to have required that Brezhnev overrule some opposition within the military and the Party. Although he may have appeased his critics with new military programs, Brezhnev's willingness to tie his political reputation to SALT, as the centerpiece of his foreign policy, probably reflected his own assessment of the depth of support for the SALT negotiations within the Party by 1972.

In the SALT II negotiations which began in November 1972, the Soviets renewed their efforts to freeze new strategic programs involving MIRV weapons. Political dissatisfaction in the United States with the SALT I balance and growing momentum in the Trident, B1, and cruise-missile programs, however, made such a technological freeze unacceptable to the United States. During the second phase of SALT, the United States sought to negotiate an agreement that permitted qualitative improvements in the American arsenal, limited further improvement in the throw weight of the Soviet arsenal, and established strategic force levels for the United States not inferior to those established for the Soviet Union.

By 1974 Moscow and the Ford administration appeared to have struck a bargain, albeit an ambiguous one, at the Vladivostok Summit. In the Vladivostok accord of November 1974 Moscow accepted a framework for SALT II based on equal aggregates of ICBMs, SLBMs, and strategic bombers. The demand for compensation for FBS was thus dropped and Moscow conceded the numerical advantage in missiles it had been granted in SALT I. The Soviets also agreed to extend the sublimit on "heavy" missiles contained in the Interim Agreement. This latter concession is a significant one since it appears Moscow had the ability to deploy, by the mid-80s, a heavy missile force, including the SS-18, in excess of the sublimit. The Vladivostok accord also provided for an equal sublimit on MIRV, which from the Soviet viewpoint limited U.S. MIRVs and allowed the Soviet Union to reach parity in MIRV systems while retaining significant advantages in overall throw weight.

Vladivostok was an ambiguous bargain, however, because it was unclear what systems were to be included in the overall aggregates. Cruise missiles and the Backfire bomber, as subsequent conflicts revealed, had a disputed status at Vladivostok. Disputes over these systems and the American election delayed further progress in negotiations in 1975 and 1976. A number of ongoing programs in a new series of strategic weapons meanwhile raised new questions in Washington and Moscow.[11]

In the "revised" Vladivostok accords, that is, the current SALT II agreements negotiated during 1977 and 1978, Washington agreed to count heavy bombers with air-launched cruise missiles (ALCM) against the sublimit for MIRVed weapons. On its part, Moscow accepted a lowering of the Vladivostok agreement force ceiling from 2,400 to 2,250, which would require overall reductions in Soviet but not U.S. strategic forces, and agreed to a new subceiling of 1,200 MIRVed missiles, within an overceiling for 1,320 MIRVed launchers. This acceptance meant, in effect, that the United States would be permitted to deploy 120 cruise-armed bombers in excess of a MIRV missile force of 1,200. Since Moscow could not be expected to deploy a comparable force of cruise-armed bombers, the effective MIRV launcher limit established by SALT II was 1,200 for the Soviet Union but 1,320 for the U.S. Moreover, Moscow agreed to a sublimit of 820 in MIRVed ICBMs.

While this limit was not as low as the United States had sought to achieve in the May 1977 comprehensive proposals, it represents a significant constraint on Soviet ability to exploit numerical and throw weight advantages contained in its land-based arsenal. Projecting from the 1976–77 MIRV deployment rate, Moscow appeared to have the ability to deploy in excess of 900 MIRVed ICBMs by 1985. In the course of SALT II, however, Moscow also agreed to verification rules that will require currently deployed single-warhead

Moscow's dual concern with augmenting strategic power while achieving negotiated restraint in the strategic competition appears to parallel the situation in Washington.

versions of the SS-17 and SS-18 to be counted against the MIRV ceiling.[12] Thus Moscow accepted a counting formula which meant that the total land-based MIRV force would probably remain significantly below the 820 ceiling. In the final stages of negotiations in 1978, Moscow also agreed to drop its demand on ALCM range limitations, to accept significant restrictions on the development of the controversial SS-16 mobile missile, and to offer Washington assurances on the deployment of the Backfire bomber in order to achieve additional restrictions on cruise deployment and other short-term restrictions on U.S. modernization in the Protocol.

While both the Soviet Union and the United States will be permitted to undertake modernization under SALT II, which will substantially augment their strategic arsenals, there can be little doubt that SALT II imposes real restrictions on Soviet strategic capability. Not only does the new agreement require an overall reduction in the Soviet missile force of approximately 150 by 1985; it also imposes limitations on MIRVing, and limits the megatonnage of Moscow's land-based arsenal. Without such restraints, Moscow could deploy a MIRVed ICBM force and a force of heavy missiles in excess of the new SALT II ceiling. Thus SALT II suggests that, while political and technological momentum behind the Soviet strategic effort may be substantial, the Party leadership has the will and ability to take decisions which probably do not have full military support.

Although the recent record of SALT provides evidence of Soviet interest in restraint, the development of Soviet strategic power since 1969 indicates that Moscow has become and is likely to remain a formidable strategic competitor. Moscow's dual concern with augmenting strategic power while achieving negotiated restraint in the strategic competition appears to parallel the situation in Washington.

The Growth of Soviet Strategic Power 1969-1978. The period since 1969 has in fact been one of intense activity in Soviet strategic programs. Yet, in assessing the impact of the Soviet effort since 1969, it must be noted that the pace and scope of American modernization programs in this period were by no means of such a limited nature that essentially systemic explanations of Soviet behavior can be ruled out. Since 1972, as a result of MIRV modernization programs for the Minuteman and Poseidon, the United States added approximately 3,500 warheads to its strategic arsenal. In addition, development programs for the cruise, Trident and MX missiles were accelerated during the SALT II negotiations. These programs no doubt have provided cause for concern in Moscow.

While the pace of the Soviet effort of the 1960s may well have created considerable technological and political momentum in strategic programs, the U.S. modernization effort during SALT provided at least a rationale, if not a reason, for the continuation of a substantial Soviet modernization effort. Conversely, the Soviet effort since SALT has increased support in Washington for a new round of strategic development.

Like the United States, the Soviet Union has focused increasingly on qualitative development of strategic forces during the SALT decade. Prior to any agreement on force limitations, Moscow substantially slowed new missile deployment. SS-9 and SS-11 deployment declined sharply in 1970. (During 1971 the Soviets deployed only about 60 new ICBMs, compared to nearly 300 in 1969.) At about the same time, "go" decisions were also apparently reached to proceed with a third-generation of follow-on systems. Introduction of a third generation of ICBMs (SS-17, -18, and -19) began in 1976 and 1977. These systems incorporated MIRV technology and possessed greater accuracy and throw weight than their predecessors. In 1973 the Delta class nuclear-powered submarine carrying the new SSN-8 missile with a range of 4,200 nautical miles entered service. Advanced development of new solid-fuel, MIRV-capable SLBM designs was also underway in 1977, and testing was reportedly resumed after a lapse of several years in so-called hunter-killer satellites.

During the SALT II regime, Moscow can be expected to sustain a range of developmental efforts related to further improvements in the Soviet strategic capability. Like Nixon, Ford and Carter, Brezhnev coupled his support of SALT with support for a strong strategic modernization effort. The momentum of the arms race is thus likely to survive



"Gentlemen, we need a new satellite to spy on the satellite that's spying on our spy satellite."

While U.S. policy should be based on the presumption that Moscow will be a tough competitor, it must avoid a tendency to ignore the clear, positive signs of Soviet interest in imposing a cap on the quantitative and qualitative competition.

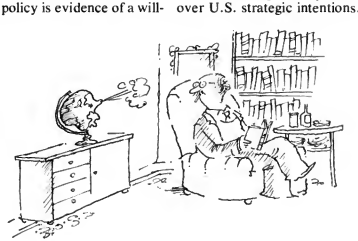
SALT II in both Moscow and Washington, although without SALT II competition would almost certainly assume more alarming and destabilizing proportions.

Although the recent growth in Soviet strategic power and the nature of Moscow's current research programs continue to cause considerable concern in Washington, the Soviet willingness to accept significant limitations on MIRVing its land-based missile force and augmenting its throw weight is important evidence of the value Moscow places on mutual strategic restraint. Significantly, the leadership does not appear to have been prevented from taking these important steps by a hard-line coalition of military interests. Indeed, the Soviet military establishment, while perhaps displeased with some Soviet "concessions" in SALT II, may view SALT not only as a useful means of controlling U.S. strategic programs in the decade ahead, but also as a means of restoring perspective on Soviet defense needs.

The inauguration of SALT coincided with a campaign within the Soviet defense establishment to correct the overemphasis which Khrushchev had placed on strategic power. Yet while evidence of Moscow's interest in curtailing the strategic arms race is substantial (and does not appear to depend only on Brezhnev's domination of the Party), the record of the last decade of Soviet policy is evidence of a willingness to bear enormous costs to deploy an awesome modern nuclear arsenal.

Moscow is capable of being a formidable competitor in the decade ahead. The Soviets are likely to continue to approach SALT from the standpoint of their immediate national security concerns rather than from any commitment to abstruse doctrines of strategic stability. Moreover, because the Soviet position has doubtlessly involved difficult internal bargaining, the rejection or revision of agreed SALT provisions by Washington is likely to produce strong reaction in Moscow, as with the case in the spring of 1977 when the Carter administration offered a set of comprehensive arms control proposals which revised much of the Vladivostok framework.

The SALT road beyond 1979 promises to be difficult. Strategic modernization improvements are likely to be undertaken by both sides as a result of continuing insecurities over the nuclear balance and in an attempt to appease internal pressures. Soviet modernization efforts and the close association of deterrence and warfighting ability in Soviet military doctrine will continue to feed the fears of many in Washington who will continue to see in Soviet policy a search for superiority. U.S. policy and the augmentation of the American nuclear arsenal likely to occur in the next several years will similarly provoke increasing anxiety in Moscow over U.S. strategic intentions.



It is in their behavior in SALT and in their moderation in undertaking modernization not prohibited by SALT that Washington and Moscow are most likely to assure each other of their strategic intentions and interest in strategic restraint in the decade ahead. While U.S. policy should be based on the presumption that Moscow will be a tough competitor, it must avoid a tendency to ignore the clear, positive signs of Soviet interest in imposing a cap on the quantitative and qualitative competition.□

1. See G. W. Rathjens, "The Dynamic of the Arms Race," *Scientific American*, 210 (April 1969), 15-25; P. Nitze, "Assuring Strategic Stability in the Era of Detente," *Foreign Affairs*, 54, 2 (January 1976), 207-232.

2. See D. K. Simes, "Detente, Russian Style," *Foreign Policy*, 32 (Fall 1978), 47-62.

3. See Richard Pipes, "Why the Soviet Union Thinks It Could Fight and Win a Nuclear War," *Commentary*, 64, 1 (July 1977).

4. R. Armstrong, "Military-Industrial Complex Russian Style," *Fortune*, August 1969, 84-90, 112-126; V. Aspaturian, "The Soviet Military Industrial Complex: Does It Exist?" *Journal of International Affairs*, 26, 1 (1972), 1-28; W. T. Lee, "The Politico-Military Industrial Complex in the USSR," *Journal of International Affairs*, 26, 1 (1972); and K. F. Spielmann, "Defense Industrialists in the USSR," *Problems of Communism*, 25, 5 (September-October 1976), 52-69.

5. E. Jahn, "The Role of the Armaments Complex in Soviet Society," *Journal of Peace Research*, 12, 3 (1975).

6. Cited in J. H. Barton and L. D. Weiler, *International Arms Control: Issues and Agreements* (Stanford: Stanford University Press, 1976), 173.

7. *Pravda*, April 8, 1978, 1. See also Brezhnev's remarks, *Pravda*, January 19, 1977, 1.

8. V. D. Sokolovskiy, *Soviet Military Strategy* (3rd edition), H. F. Scott, ed., (New York: Crane Russak & Co., 1975), 197.

9. For a recent analysis of these changes, see G. N. Svyatov, "O politike sh a v oblaste stroitel'stva voorhzhennyx sil e·ogranechania," *Voprosy Istory*, 2 (February 1978), 66-92.

10. See, for example, the speech by Marshall Grechko, *Pravda*, February 23, 1971, 2.

11. For a summary of the formal Soviet position during this phase of SALT, see "Zadacha ogranichenia strategicheskikh vooruzheny: perspektivi i problemi," *Pravda*, February 11, 1978, 4.

12. See R. Burt, "The Scope and Limits of SALT," *Foreign Affairs* (July, 1978), 751-771.

To veterans of the civil defense wars the newest paper relocation plan is an old familiar.

DAVID F. CAVERS

That Carter evacuation plan

The New York Times, at the top of its first page on Monday, November 13, 1978, carried a news story from Washington with a surprise two-column headline, "Carter Adopts a Program to Bolster Civil Defense in a Nuclear Attack." The subhead explained, "Plan Calls for Doubling Annual Spending in 5 Years, to Keep Pace with Moves Made in Soviet Union."

The news story that followed gave a sketchy description of the Carter Plan, reporting it to be "a controversial decision, contained in a secret White House document," issued in October. However, the proposal's undeveloped state did not inhibit The Times from giving it a megaton blast in an editorial the day after its release. The newspaper also observed that the President's "real concern, of course, is not for the defense of the population against the Russians but the defense of an arms control treaty against the Senate."

However, when the President was asked at his November 30 press conference whether "the decision on civil defense"—if one had been taken—was "part of a plan to sort of pull the fangs of the anti-SALT people . . . part of a SALT dance rather than an independent action," the President's response was, "I don't think it's part of a SALT dance." He went on to declare that "press reports about a $2 billion civil defense program have been completely erroneous. . . . No proposal has ever been made to me for a civil defense program of that magnitude." (New York Times, Dec. 1, 1978)

On December 6, 1978, in a special dispatch to The Times from Washington, headed "Civil Defense Drive," the correspondent, Richard Burt, insisted that "American officials acknowledge that the program is also designed to help lay the political groundwork for Senate approval" of a SALT treaty "by catering to the concerns of Congressional conservatives."

The same dispatch reported a Pentagon proposal for an increase in the civil defense budget from the current $90 million or so to $145 million for the fiscal year that began October 1. Moreover, on December 2, 1978 Burt had reported that "Defense Department aides confirmed that the projected five-year cost of the evacuation plan was $1.3 billion," and that "they estimated the total cost of carrying out the new program over seven years . . . at $2 billion."

Apparently those viewers-with-alarm , who since the early 60s have been warning against the vast Soviet civil defense preparations, had made some impact on the Administration. But for evidence of the primitive stage of the new civil defense planning, one should turn to a press conference held the day after The Times' initial story. This conference was called by Bardyl R. Tirana, Director of the Defense Civil Preparedness Agency, a body designed to be merged with several others into a new Federal Emergency Management Agency.[1]

At the November 14 conference, called to announce a new "emergency satellite communication system," Mr. Tirana was quizzed as to the cost of the proposed "crisis relocation program" for evacuees from cities threatened with nuclear attack. Tirana professed ignorance. "We're still working on the design of the program," he said. He did, however, describe the objective of this "paper plan" in terms that scarcely could reassure conservative Congressmen. In straightforward bureaucratese, he called it "a modest and relatively inexpensive means of designing and implementing a capability of protecting the population to some extent."

Moved from high-risk blast and fire areas, evacuees could construct "expedient or hasty fall-out shelters." Food supply he saw as simply a matter of "organizing your food supply chain. Instead of bringing it into the inner cities, to bring it to the host areas." Such areas, it seems, might entertain up to seven guests per host.

People in congested areas like the Northeast Corridor and Los Angeles should hope that "the plan itself would contribute, in a small way, to the avoidance of nuclear war." They'd better; they would probably be included among the 70 million or so that the plan, "if completely effective," wouldn't save.

At the close of the conference Tirana made a confession not likely to be challenged. "It's the problem that is staggering. It's mind-boggling."

The essence of the new plan which its mind-boggled architects are designing is an old familiar to veterans of the civil defense wars. Endangered populations are to be evacuated and relocated. But something new is to be added. Unlike past evacuation schemes, this one is not triggered by word that Soviet missiles are on the way; the new plan is turned on by news that a Soviet evacuation has begun.

Our hard-liners accept the Soviet claim to be able, *in only 72 hours,* to evacuate all those city dwellers whom their blast-proof shelters can't accommodate.[2] The Administration's new plan works more slowly; thus, a feature story by the United Press International which appeared in The Boston Globe on Nov. 19, 1978, reports that it would take eight days to evacuate 80 percent of the Los Angelenos. Differences of that scale



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in evacuation speeds lead one to wonder just how our new plan is going to deter attack or save all but about 70 million city dwellers.

To think about the unthinkable in this context, a scenario may help. The one that follows take place after our paper plan has been completed.

First, one must assume a crisis. Presumably no Soviet evacuation would be ordered if no crisis had arisen in U.S.-Soviet relations. Let us assume that the Soviets seem on the verge of invading a large oil-bearing state on their southern border, a state which we shall suppose the United States had long regarded as a protégé. Our vigorous protests are unheeded. Then comes news that Soviet cities are being evacuated. At once the evacuation signal flashes via satellite to our network of civil defense offices. The sirens blow. As traffic begins to jam the evacuation highways and our nuclear forces are readied for action, a firm demand goes to Moscow: The arms build-up on the border must cease. This is ignored. Three days pass; the Soviet evacuation is complete; their urban citizenry are now furiously digging shelters in the countryside with the shovels they brought with them. What happens next?

Perhaps the Soviets could not resist the temptation to launch a nuclear strike at this country while it is in the throes of an indescribable transportation tangle. Might we not strike at them once our own evacuation had been completed? There is, in fact, a resemblance to the mobilization-countermobilization sequence that touched off World War I. But assume that they resist that temptation. Instead, they rapidly overrun their southern neighbor. We are faced with a *fait accompli* while still struggling with the desperate supply and shelter problems of our hungry, frightened evacuees. Will our then-President feel compelled to trigger a first strike of our own and so prove our nation undaunted? If he does not, and if our opponent doesn't, the thankful evacuees on both sides can return to their homes. Our undeterred adversary will have added to its oil reserves. Our counter-evacuation will have exposed us to awesome risks—to no avail.

Whatever events might dictate evacuation, obviously speed in its execution is essential. The Soviet Union's 72-hour timetable, untested in any large-scale experience, seems highly implausible, given their shortages in roads and carriers, including motor vehicles.[3] However, their citizenry has had long-continued indoctrination in civil defense procedures and far greater exposure to regimentation, economic hardship, and war on their own soil. Probably therefore, a considerably higher percentage could be moved out of their urban centers in 72 or even 144 hours than the percentage of American city dwellers who could be evacuated from our urban centers in the same time.

Would the evacuees be able to reach safer places than the ones they left? Would even completed evacuations mean survival for evacuees on either side if an all-out nuclear war were the sequel? How can we assume that the people encamped in improvised shelters in either nation would escape attention when missiles were targeted? Moreover, the Soviets emphasized large H-bombs in their testing before the 1962 test-ban treaty became effective. Those huge missiles could be exploded at high altitudes, spreading devastation by fire and blast over areas stretching for many miles from the target center. Supplemented, perhaps, by fallout from groundbursts, such an attack on the exposed hordes of evacuees could nullify the evacuation.

Even if vagaries of wind and weather or a reduced number of bombs deliverable in a counter-strike were to leave many evacuees on one side unbombed, what would be their survival prospects in the winter to follow, with their cities, centralized industries, transport systems, hospitals, and supplies of most of the necessities of life reduced to rubble, possibly radioactive rubble? Even those who view the Soviet system with alarm do not report solutions to their post-attack survival problem. The President's new plan, Tirana optimistically surmises, will draw on post-World War II experience to cope with it. But what power will be our Uncle Sam—China?

The UPI reported in. The Boston Sunday Globe, Nov. 19, 1978, that the Carter plan seems to be concentrating on providing "detailed instructions" on how to flee rather than tackling survival problems. Apparently, sample tabloid fliers containing these instructions have already been printed for use on a test basis in nine areas around the country. Now the President wants "to expand these feasibility tests into a paper plan for about 400 communities ranging from New York City to small cities like Great Falls, Montana, which could be threatened because military bases are nearby."

The plan for evacuating large metropolitan areas relies heavily on commercial airliners. Thus, UPI states that planners "envision airlifting up to 1.5 million persons from the New York area airports to western New York State." Having tried, at various times, to get to airports late in the afternoon in Boston, New York, Philadelphia, Washington and Chicago, I consider this concept a triumph of creative imagination.

Another source of skepticism as to evacuation emerges in an unclassified summary of a report of the United States Arms Control and Disarmament Agency, dated December 1978:[4]

The ACDA report doesn't deny that evacuations from the hundreds of Soviet cities now targeted for their industrial and military installations could in the short term save many lives from a U.S. retaliatory strike—but only if the evacuations were successfully completed, an achievement the ACDA considers unlikely, with the price of failure very high. Moreover, the report finds that losses would be stepped up if we targeted our missiles to reach evacuees and use the high-potency missiles of the 80s rather than

If political pressure for an evacuation plan builds up, the past teaches that the plan can still be defeated by an intelligent, informed population.

the old '79 models on which the ACDA study was based. Note that these conditions apply even more clearly to an attempted evacuation when a Soviet first strike was impending.

The ACDA report analyzes the effect on our retaliatory power of a Soviet first strike when our strategic forces were on a normal day-to-day alert , and when those forces were on an alert generated by war-threatening tensions. Word of Soviet evacuations would, of course, lead to a generated alert and so would increase the striking power of our surviving forces for retaliatory action. Similarly, knowledge that evacuation of our own cities was underway could generate a Soviet first strike.

The ACDA report doesn't consider in detail the plight of the survivors of a first or a retaliatory strike. With cities in highly radioactive ruins, with their water power and transportation sometimes destroyed, and medical personnel and facilities all but eliminated, the survivors' lives would, in Hobbes' terms, be "nasty, brutish, and short." Moreover, destruction might not be limited to Earth. A 1975 National Academy of Sciences study[5] is cited, indicating that the ozone layer over the Northern Hemisphere might become so depleted that exposure to sunlight could blister man in from 10 to 90 minutes and could kill many plants and animals. Though most serious the year after the attack, ozone depletion might continue six to seven years. Evacuation to the Southern Hemisphere has yet to be proposed.

We are fortunate in having a knowledgeable, if not powerful, agency of the government prepared to speak out against the scheme that seems to have the President's blessing. If, however, political pressure for an evacuation plan builds up, the past teaches that the plan can still be defeated by an intelligent, informed citizenry, aided by the Administration's own parsimony and the refusal of the American public to stay scared for long. A look back over our previous civil defense experience could be illuminating.

When, in the 50s, the American people first became aware that the Soviet Union could construct atomic weapons, we began a rather leisurely approach to civil defense against this hazard. Attacks were seen as being carried out by bombers; air defense, alerted by early warning systems, was to be our chief protection. No doubt some bombers would get through, and their bombs would probably create areas of devastation in target cities. With a few hours' warning, however, citizens were expected to get out of town as best they could. Reliance on airbursts as at Hiroshima and Nagasaki was assumed so fallout was no problem.

On these assumptions, evacuation of likely target areas was the tactic of choice. Unfortunately, no adequate post-attack plans were developed to enable the nation to pull gravely damaged financial, industrial, transportation, and distribution systems together again. The foreseeable damage, though severe, could then have been mitigated by precautionary planning.[6] The aftermath of atomic war threatened to be more perilous than the war itself.

Carter's plan is no better in this respect, and its shortcomings are shared by all intervening plans. Moreover, the problems of recovery that would be posed today are vastly more serious than those threatened by a primitive atomic war in the 50s.

As the 50s neared their close, the nature of atomic warfare began a sinister transformation. The A-bomb became the H-bomb. Stockpiles in both the United States and the Soviet Union were building up, and the bombs growing larger. Delivery systems also began to change. The intercontinental ballistic missile took over much of the bomber's role, and the Nike-Zeus missile defense system was not expected to be operational for five years. (It never became so.) Even if an enemy's missile silos were knocked out by a first strike, the menace of the still invulnerable missile-bearing submarines remained. A new civil defense strategy was required.

Most important in the new strategy was the widespread acceptance of fallout as the principal menace. The H-bomb was seen as having the capacity to generate vast amounts of nuclear radiation by groundbursts, irradiating particles of earth and debris and spreading them, while still lethal, over wide areas. At some distance from ground zero, however, protection against this fallout could be provided even by sheltered corners in home and office basements. Nearer the target, sealed (but ventilated) underground—though not blast-proof—shelters would be required. Stocked with supplies, these were to enable their occupants to remain inside till the surroundings were less radioactive. Consequently the provision of such shelters for all inhabitants of threatened cities became the goal of civil defense. Evacuation was dismissed—there would be no time for it.

In spring and summer of 1961, President Kennedy responded to Cuban and Berlin tensions by calling for fallout shelters as "insurance" against "irrational attacks, miscalculations and accidental wars" and sought $207 million for a program to identify and stock shelter spaces.[7] At that time I joined with 179 university faculty members in the Boston area in placing a protesting ad in The New York Times for November 10, 1961. Our appeal was lengthy, reasoned, and moderate in tone. It was republished by faculty groups in 14 other newspapers, amassing a total of about 3,500 signers. Groups in opposition to the program multiplied. Our group, after organizing as the Boston Area Faculty Group on Public Issues—BAFGOPI for short—later turned to initiating ads that called for disarmament and ads protesting our Vietnam policy.

Some BAFGOPI members, myself included, carried on the group's opposition to the shelter program by appearances before the Sub-Committee on Independent Offices of

One may hope that by now the Kremlin is sufficiently sophisticated in the ways of American politics to realize . . .

the House Appropriations Committee in 1962 and 1963 and Sub-Committee No. 3 of the House Committee of Armed Services in 1963.

This opposition had three principal bases: First, given the weaponry coming into existence, fallout shelters would provide far less protection than their advocates were representing. Second, the federal government was thrusting much of the economic burden imposed by its inadequate program on local governments, private industry, and, worst of all, non-profit institutions and individual homeowners. And third, the shelter program could be sold to the public only by creating and maintaining a spirit of fear and hostility toward the Soviet Union which would make nuclear war more, rather than less, likely. These positions can only be summarized here.

• By concentrating on the perils of fallout, the shelter program diverted attention from the fallout-producing groundbursts which would destroy shelters over a wide area and set fires over a still wider one. Moreover, airbursts of those multimegaton bombs the Soviets had been testing could magnify blast and fire destruction while causing no fallout whatever.

Dr. W. F. Schreiber of M.I.T., a BAFGOPI member, argued that many people outside the circle of complete destruction might escape—for a time at least—by abandoning fire-endangered shelters for their cars and heading away from the path of the wind-blown fallout. His arguments were predicated in part on the official Atomic Energy Commission work, "Effects of Nuclear Weapons," published in 1962.[8] As for the perils confronting survivors—they weren't on the Office of Civil Defense agenda.

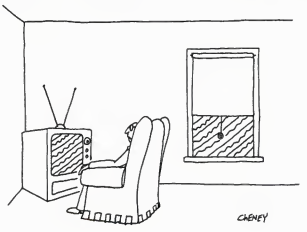
• Though the Armed Forces gave civil defense strong verbal support—"a major element of the total U.S. security effort," testified Major General G. E. Wheeler of the Joint Chiefs in June 1963[9]—the Department of Defense did not press for large appropriations. The reluctance of the Administration and the Congress to "put their money where their mouth was" testified to the relative importance they attached to the defense programs. Although the Berlin crisis loosened federal purse strings in 1961 for appropriations of $207 million, the Congress cut back a request for $695 million in 1962 to $113 million.[10] The result was to block OCD's Shelter Incentive Program, which would have cast much of the burden of providing 100 million fallout shelters on schools, hospitals, and other non-profit institutions.

Briefly, the cost-sharing plan for non-profit institutions with basements providing at least 50 "shelter spaces" (10 square feet each) would have cast on them a cost of $1.5 billion. The next year came a modified one-year $175 million plan to provide, at Federal expense, 10 million low-cost shelters in institutions. The Congress, however, did not let this camel's nose into the tent.

• The rapid rise and fall of the shelter program demonstrated that fear is what is needed to make a large-scale peace-time civil defense program work in a democratic state. The public, worried by the fallout caused by bomb-testing, had rapidly been confronted by mounting tensions in East Asia and Cuba and then by the Berlin crisis. A nuclear war with the Soviet Union suddenly seemed a clear and present danger. Some citizens protested, but a great many began building basement or backyard shelters. When Khrushchev backed down, the fear index dropped and shelter-mania rapidly subsided.

In sharp contrast both to past Administrations' unwillingness to assume the full burden of their own proposals and also to the present Administration's long-term "paper plan" approach to the "crisis relocation" of city dwellers are the recently revealed preparations by previous Administrations. These call for the evacuation by helicopter from Washington of 4,000 federal officials deemed essential to the continued operation of the government. In a story by P. J. Sloyan of *Newsday* in the Boston Globe, Dec. 18, 1978, it was disclosed that $1 billion had been found in the interstices of past federal budgets to construct a secret system of huge, fully equipped and staffed shelters in the Appalachian Mountains in Maryland and North Carolina.

This vast enterprise is now being evaluated by Director J.A. Mitchell of the Federal Services Administration in the General Services Administration. Suspicions have been voiced that today's nuclear weapons could destroy even "Mt. Weather," the name applied by Sloyan to the main underground shelter to which the Congress, the Supreme Court, and Cabinet members are slated to be sent (without wives and children). Sloyan quotes a DOD analyst as predicting that, if attacked, Mt. Weather would



. . . that some bellicose gestures may be a necessary prelude to Congressional acceptance of any significant move toward peace.

be "turned into a gravel quarry." In any event, the President and a few top aides would not have to depend on the super-bunkers. They would be airborne in a Boeing 747.

But how could an Administration that really believed its own spokesmen succeed in making a nationwide civil defense program a genuine "major element in the total U.S. security effort?" Obviously a tough, aggressive foreign policy, duly backed by propaganda, a stiff-necked position in every dispute with the Soviet Union, a readiness to invite confrontations—these would be the ingredients needed to keep sharp the public's fear of nuclear war. The result: a deeply anxious, threatened public ready to demand more billions for better shelters and still more billions for bigger weapons. How long could this new militarism continue without setting off a nuclear Armageddon? And, even if the armed truce could be maintained, what would happen, in time, to our ideals and our institutions?

About six weeks after the 1963 Congressional hearings, the National Academy of Sciences, at the request of the Assistant Secretary of Defense for Civil Defense, met for six weeks at Woods Hole, Massachusetts, to produce a comprehensive study of civil defense. For this meeting, known as "Project Harbor," 63 participants were assembled, drawn chiefly from the sciences and the defense bureaucracy. Presiding was Dr. Eugene P. Wigner, Princeton physicist, who had had a leading role in the development of atomic weapons and who is still an active protagonist of civil defense. Aiding the participants were 88 "briefers," consultants, and observers, drawn from a somewhat wider spectrum, even including one DOD lawyer. Six panel reports, reflecting only "a few points of disagreement," were submitted by the Academy to the Office of Civil Defense early in 1964, and a summary report was issued to the pulbic. The full report runs approximately 1,000 pages.[11]

The report evidenced a greater readiness to face up to actualities than the thinking that led to the fallout shelter program. Yet it also evidenced the familiar pessimism about adversaries' intentions and the usual optimism concerning our ability to cope. It projected a blast-shelter system, estimating away the system's economic demands, but it recognized that "it would be reasonable to spend more on recovery measures than on the shelters themselves, though probably not twice as much."[12]

The Woods Hole Strategy and Tactics panel expressed hope in its summary that the probable period of tension antecedent to a nuclear war would provide "days to months of strategic warning" and so would permit "crisis actions, such as strategic evacuation and improvised shelter construction." However, the summaries of the other panel reports make only two bare and incidental mentions of evacuation. Seemingly disappointed, the Strategy and Tactics Panel urged that "planning that would render such crisis actions effective," be "carried out as soon as possible."[13]

President Carter's response to this appeal is nearly 15 years late, but the designers of his paper relocation plan need not worry about the escalating costs of an ongoing blast-shelter program. Unlike the Project Harbor experts, they cannot pin some hope on the effectiveness of a projected "anti-ballistic missile system." Probably, being preoccupied with current budgetary pressures, the President will not be too perturbed when the Congress cuts back the funds requested for the new project, provided his proposal discharges the political function which the perceptive editors of The New York Times see for it. One may hope that by now the Kremlin is sufficiently sophisticated in the ways of American politics to realize that some bellicose gestures of this sort may be a necessary prelude to Congressional acceptance of any significant move toward peace.□

1. Office of the Secretary of Defense, Transcript of Proceedings, Nov. 13, 1978.

2. See, for example, Leon Gouré, "Another Interpretation," *Bulletin*, (April 1978), 48-49.

3. Fred M. Kaplan, "The Soviet Civil Defense Myth," *Bulletin*, (March 1978), 15, 16-17.

4. See also U. S. Arms Control and Disarmament Agency, An Analysis of Civil Defense in Nuclear War (Dec. 1978) 22 pp., submitted at a hearing before the Senate Committee on Banking, Housing and Urban Affairs. The Committee also heard testimony on January 8, 1979, by S. B. Drell, "A physicist with a background of 19 years of war on national security problems of the United States as a consultant to various offices and departments of the U. S. Government." In concluding an extended analysis he stated: "If nuclear war ever happened to occur Civil Defense could do little to improve our prospects of survival, much less our victory."

5. See "Long-Term Worldwide Effects of Multiple Nuclear Weapons Detonation," National Academy of Sciences, Washington, D.C., 1975.

6. David Cavers, "Legal Planning Against the Risk of Atomic War," *Columbia Law Review* 55:2 (Feb. 1955), p. 127.

7. Addressing Congress on May 25, 1961, the President denied that civil defense was needed to deter attack. Strong retaliatory power was essential, and civil defense would not be "an adequate substitute." *Congressional Record*, Vol. 107, Pt. 7, p. 880. See also "Long-Term Worldwide Effects of Multiple Nuclear Weapons Detonation," National Academy of Sciences, Washington, D.C., 1975.

8. Testimony of W. F. Schreiber, Hearings before House Armed Services Sub Comm. 3, Pt. 11 (Vol. 2), pp. 4565-4600 (June 24, 1963). The impact of his testimony was weakened when certain assumptions in the official work were disavowed by the Director of Research for the Office of Civil Defense in the same Hearings, pp. 5085-87, 5096-97.

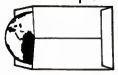
9. Hearings before House Armed Services Committee, Sub-Committee No. 3, Pt. II, Vol. 1, pp. 3653 (June 3, 1963).

10. The Senate had voted $93 million to start shelter construction, but the refusal of the House to fund the program prevailed in conference. See *Congressional Record*, Vol. 108, Pt. 15, p. 20626 (Sept. 25, 1062).

11. Civil Defense—Project Harbor Summary Report, Publication 1237, National Academy of Sciences—National Research Council, Washington, D.C. (1964).

12. Civil Defense—Project Harbor Summary Report, the Postattack Recovery Panel's Summary, pp. 21-27.

13. Civil Defense—Project Harbor Summary Report, pp. 10-11, 15 and 17. Undoubtedly, in the full report, evacuation has been considered at more points and greater length. However, the minimal treatment accorded it in the document prepared for the public is significant.



GENE R. LA ROCQUE

The first nuclear war conference

On a chilly, rainy Washington morning, 37 years to the day that the Japanese launched a surprise attack on the American forces at Pearl Harbor, over 300 invitees and participants to the First Nuclear War Conference spent a day listening, thinking and learning about how a nuclear war could start; how it would be fought and what the results would be. We did not offer solutions at this conference. It was our hope that this first "clinical" meeting would encourage people to give serious thought to the wider implications that uncontrolled weapons build-up has on increasing the likelihood of a nuclear war. To my knowledge, in the 33 years since the first atomic bomb was exploded in the deserts at Alamogordo no one has actually thought out in these terms what a nuclear war would mean to the continuation of life on this small planet.

For the past few years Richard Barnet and I had talked about holding such a conference. The actual impetus to finally take the plunge came during the U.N. Special Session on Disarmament. There in New York, in the offices of Governor Averell Harriman, we gathered with the elder statesman and the actor Paul Newman to discuss what we could do to educate the public about nuclear war. There was general agreement that the United States had virtually disavowed any interest in the U.N. session. Our small group believed that if the message of the Special Session was to reach the American people, it would have to be presented some other way. Dick Barnet and I agreed to co-sponsor the First Nuclear War Conference under the auspices of the Center for Defense Information and the Institute for Policy Studies.

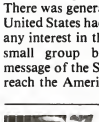
Although the American public has grown more informed on such current issues as consumer rights, government spending, and civil liberties, there has been an almost total lack of information on the growth and sophistication of nuclear weapons, the size of their arsenals, and the threat that the nuclear arms race poses to survival on this planet. Living in a world where nuclear devastation could take place within 30 minutes from missiles launched by either the United States or the Soviet Union made it imperative that we emphasize that in a nuclear war there would be no winners. Furthermore, the impending debate on SALT II and the renewed emphasis on civil defense begged a wider campaign on our part to educate the public about nuclear war and the nuclear arms race.

The conference, organized around three panels, focused on various aspects of nuclear war. Panel I, *How a Nuclear War Can Start*, chaired by Ruth Adams, Editor, *Bulletin of the Atomic Scientists,* included Richard A. Falk, Professor of International Relations, Princeton University, Jerome D. Frank, M.D., psychiatrist from Johns Hopkins University, G. B. Kistiakowsky, Professor from Harvard University and a former science advisor to Presidents Eisenhower, Kennedy and Johnson, and Harrison A. Salisbury, author and journalist, former associate editor of the New York Times. Each of these panelists was asked to prepare a statement and the result produced several scenarios describing the outbreak of nuclear conflict. This issue of the *Bulletin* presents the discussion from this first panel. Subsequent issues will present the discussion of the other panels.

What made this conference unique was that never before in the United States had such a conference been sponsored by non-military organizations. If the 1960s preached the thinking of the unthinkable, in practice any discussion was honored in the breach. To summarize the main points of the conference, there was a consensus among the panelists that:

- A limited nuclear war would inevitably escalate into a full-range general nuclear war.
- To believe that one could win a nuclear war was insane.
- Civil Defense programs geared to the evacuation of cities were illusory. Long term effects of a nuclear exchange would nullify this program.
- We really know very little about the nature of nuclear warfare. Dry numbers can be no substitute for what in reality would take place: death, destruction, psychic trauma, chaos. As Nikita Khrushchev put it, "the survivors would envy the dead."

Senator John Culver, who made the keynote address, quoting the first century Roman historian Tacitus' description of the conquering Roman legions, remarked: "They made a desert and they called it peace." We have come a long way from the empire of Rome, but the perception of devastating effects of war, be it conventional or nuclear, have changed little. In past conventional wars we have been able to rebuild in the midst of destruction. In an all-out nuclear war the words of Tacitus would ring true, except this time there would be few left on earth to call it peace.□



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Next month: How a nuclear war would be fought.



Panel I

How a nuclear war can start

. . . in the Middle East

RICHARD A. FALK

I am reluctant to sound like an alarmist, yet I feel a gloomy apprehension that we are entering a period in the history of the world that poses a greater danger of nuclear war than any that we have known, and that we are entering this period psychologically unprepared and unaware of the kind of risk that confronts us. Part of my reason for avoiding gloomy apprehension is that it is neither personally congenial nor politically effective, yet the more I have thought about the kinds of tendencies that I see occurring in the world, it seems to me as a citizen of the United States and as a citizen of the planet it is critical that we take account of this awesome reality.

One disturbing feature of this new situation is the degree to which the leadership of our country and of the Soviet Union appear to be indifferent to the menace. This indifference was nowhere better expressed than the neglect they accorded to the U.N. Special Session on Disarmament held at the United Nations last spring, because that was the first opportunity really since the end of World War II for the leaders of the superpowers to exhibit at least a concern for the kind of world situation which was unfolding. Their failure to do so seems to me to indicate how preoccupied the superpowers are with the game of world politics and the competitive, destructive logic of pursuing illusory advantages in the nuclear age.

The reason why this present situation seems so critical is that general wars in the past have always occurred when a great power tries to compensate for economic and political decline by recourse to decisive military means. At the present time I believe that the American leadership is increasingly trying to offset a reality created and expressed by the weakness of the dollar in economic terms, and by the loss of control over the Third World in resource terms. The United States is increasingly trying to offset that weakness by relying on military superiority, and it is in that context of offsetting political and economic disadvantage with the pursuit of military advantage that the most horrible of wars in the past have occurred.

The crux of this deteriorating situation is the link between the Arab-Israeli conflict in the Middle East and the realization that Persian Gulf oil is essential to the viability of the entire non-communist, advanced industrial world. And it is in that context that core interests of the United States and, in more general terms, of the advanced industrial trilateral countries appear to be most critically at stake. And it is in that context that the attempt to meet a deteriorating political situation with military means poses the greatest danger.

The reason why the Persian Gulf-Middle East conflict is so dangerous is because those interests are threatened in a context of changing military doctrine, strategy, and war plans. Increasingly there is an emphasis by the American leadership—expressed by the initiation of a civil defense program, expressed by the renewed advocacy of limited nuclear war as a realistic policy option—that nuclear weapons must be used as active instruments of foreign policy in settings other than the defense of vital interests against a direct armed attack. In other words, nuclear weapons are being designed and our sensibilities primed for their conventional use.

The Soviet Union appears to be acquiring more weapons than it would need to deal with the United States. The United States is moving toward a first strike counter-force doctrine and capability that is extremely threatening to the Soviet Union. Therefore both sides have abundant grounds for being apprehensive about the military posture of the other.

In this context, any kind of intelligence failing—deliberate or negligent—has an extremely dangerous potential. Only very recently we have seen the capacity for intelligence failings by the inability to grasp the explosive character of the revolutionary storm gathering in Iran.

In my view it is this mixture of weapons, doctrine, psychological ambiguity and a fundamental unwillingness to acknowledge the need to adjust to our economic and political decline in the world that is the very essence of the problem which makes it so likely that we will come very close to nuclear war in the next decade—if we are lucky enough only to come close to it.

A quite plausible series of events in the Middle East seems likely to trigger this danger. We have already seen the beginning of such a train of events in the extraordinary revolt against the repressive rule of the

Shah in Iran. I think we will also soon see the repudiation of the kind of policies Sadat has brought to Egypt, the outlook Hussein is associated with in Jordan, as well as the west-leaning geopolitics of Arab polities throughout the Persian Gulf. This de-westernization of the leading governments in the Middle East is likely in my judgment to lead to a much more militant OPEC posture, to an attempt by America to mount an interventionary counter-offensive and to provide a nuclear shield for Israel, and to the Soviets providing a counter-shield for the Arab countries.

It is in this context that a clear and present danger of World War III exists. We are not working feverishly to avoid this disaster. Indeed, we are pursuing a series of military and diplomatic initiatives that are helping to bring it about.□

. . . in the Far East

HARRISON SALISBURY

An area of the world where all the elements for nuclear war are actually in place is the frontier between the Soviet Union and the People's Republic of China.

If we were to talk to our Chinese communist friends, they would say that the chance of major war is much greater between the Soviet Union and the United States than it is between the Soviet Union and communist China. I would beg to differ on that point. There are many reasons for this. The preparations for war on both sides have been active for at least a period of about 10 years. Each side has devoted itself enormously to placing very large military forces along that long frontier. It is estimated at the present time that about one-third of the Soviet arms strength is now concentrated along the frontiers of the People's Republic, either in Siberia, Kazakhstan, or in the People's Republic of Mongolia, and large segments of that force have been present there for at least 9 years.

The alarming characteristic is that nuclear forces are deployed in very substantial numbers along that border. This is particularly true as far as the Soviet Union is concerned, and I believe it has been established that in recent years the Soviet nuclear missiles have been placed in hardened sites, and have been zeroed in on Chinese targets. I believe this is true and the Chinese believe it to be true.

If you were to go to a city called Huhehaote, the capital of Inner Mongolia, you could take a drive under that city for nearly half an hour along a tunnel big enough for trucks and automobiles to pass, designed to evacuate the population of around 800,000, into a nearby mountain protective region in case a Soviet strike should occur. However, if you talk to the officials of that city, you quickly learn that the Soviet nuclear missiles are so close to the frontier that even were they to receive a warning in Huhehaote as the missiles were taking off there would not be time enough to alert the population of Huhehaote to get into those tunnels.

Nuclear war in that area of the world is a genuine, ever-present fear in the minds of the people and in the minds of the governments. It is quite clear that this fear of nuclear war exists on the Soviet side as well. Anyone who has traveled in Siberia in recent years has found that the Soviet citizens in that area are concerned and probably as ordinary individuals do not want war; but if it should come, I suppose they would favor a first strike on the part of their government, believing that if it were not a first strike by the Soviet Union, they might well be wiped out despite the precautions.

I have no doubt in my mind that if warfare were to break out between those two great countries, and certainly one would hope that it would not, it would be of a nuclear nature. I don't think anyone in China considers that the Soviet Union would attempt to overrun the People's Republic with conventional arms, even the very advanced conventional arms which they have now deployed along the Chinese frontier.

The enormous amount of funds, of manpower, of civilian defense efforts which have been undertaken by the People's Republic are a clear indication that they regard nuclear war as a Number One threat. So far as the Chinese are concerned, it is a clear and present danger; and they would anticipate that it would start with the first strike from the Soviet Union and that it would be of a nuclear nature.

Now, we might say to ourselves, this is a far away danger, and we are concerned here with the possibility of nuclear war between the Soviet Union and the United States, possibly a hypothetical future in which surrogate powers in the Middle East might trigger some sort of nuclear confrontation there which would then bring in the Soviet Union and the United States into a full-scale confrontation. These, of course, are possibilities which we must recognize; but the truth of the matter is that the place where a nuclear war is a genuine reality is along that 4,500 mile frontier between the People's Republic of China and the Soviet Union.□



(left to right)
Harrison Salisbury and
George B. Kistiakowsky

. . . from an unrestrained arms race

GEORGE KISTIAKOWSKY

Wars are caused by geopolitical and economic conflicts and not by technological innovations. However, the wars of the recent past have followed technological arms races which created military instabilities and triggered what General Klausewitz called "the extension of diplomacy." War is the probable outcome of the 30-year unrestrained nuclear arms race. The world sees the race as evidence that the superpowers regard nuclear weapons as their chief instrument of foreign policy.

The nuclear arms race is entering an especially dangerous phase. The comparatively stable state of mutual deterrence assured by secure retaliatory strategic forces is being breached by counterforce tactics and the weapons systems designed to carry out these tactics. Counterforce capabilities give the advantage to the adversary who strikes first. The primary culprit is MIRV, an intercontinental missile with multiple independently targetable nuclear warheads and superprecise guidance. This missile was developed by the United States at a time when the U.S. strategic forces were superior to the Soviet's but hardliners in Washington asserted that the Soviets were building impregnable defenses which only MIRV could penetrate.

During the Nixon Presidency, the doctrine of counterforce strikes replaced the justification for MIRV. Counterforce is not deterrence. To make military sense, counterforce strikes against hardened missile silos should take place before the opponent's missiles are launched. This is almost the same as advocating a first strike and, of course, that means nuclear war. Calling openly for a first strike has not been acceptable since the statements of General LeMay.

During the SALT I negotiations in the late 1960s, farsighted individuals pleaded that the U.S. development of MIRV would be followed by Soviet development and increased military instability. They urged suspension of MIRV testing by mutual agreement. But the hardliners won and the deployment of MIRV began about eight years ago. The Soviet Union has also begun to deploy MIRV and thus the erstwhile proponents of MIRV are pressing for more arms.

Neither the United States nor the Soviet Union possess MIRVs accurate enough to assure high kill probability of the missile silos; but the retrofitting of the Minuteman III ICBM with bigger warheads and more precise guidance is under way in the United States. It has been said that these missiles will be effective as counterforce weapons. Even more accurate, more numerous and bigger warheads are promised for the MX missiles. Such improved weapons may be truly lethal to Soviet ICBMs which comprise a much greater part of their total strategic force than the silo-based Minuteman missiles of the United States. The Soviet Union, of course, is engaged in similar innovations and according to U.S.estimates, the heavy SS18 missile might be lethal to the U.S. Minuteman in less than a decade.

When these innovations are completed, the adversary that strikes first could expect or hope to achieve a substantial weakening of the opponent's strategic retaliatory force. But would that make much difference in the bitter end? Not much. The destructive power which would remain is many times what would suffice for nearly total devastation of the opponent. We must anticipate that when such weapons are deployed, U.S. and Soviet political leaders will be under great pressure to be the first to press the button to Doomsday when an international crisis appears to be beyond control, and especially so if news arrives that the opponent has begun to evacuate its cities. Such would be the nonbenign effect of the misguided current crisis plans of civilian defense authorities.

Thus counterforce capabilities could propel us into an all-out war. On the other hand, all-out war might start more gradually as a consequence of the use of tactical nuclear weapons. For example, the mininukes in Europe were favored by Defense Secretary Schlesinger because their battlefield use is more likely to be authorized by the President that that of bigger warheads.

Take the neutron bomb—its concept is not very recent nor very novel. It is a mini-version of the H-bomb. The neutron bomb offers the same destructive power by blast and heat as an atom bomb, but it sends out nearly 10 times more powerful neutron or ionizing radiation. Tanks and other armed vehicles are quite resistant to blast and heat but neutrons penetrate steel armor and brick walls readily. Therefore, the neutron bomb would incapacitate almost instantly the tank crews in the proximity of the explosion and cause fatal radiation sickness to those in the area.

The President has ordered the production of some components of the neutron bomb probably as a preliminary step to their deployment in Europe in several weapons systems. Such deployments would be highly regrettable. Reliance on neutron bombs would lower the threshold to nuclear war.

Battlefield nukes would have to be deployed near the eastern borders of the NATO countries. To be effective against tank-led attacks, they would have to be used early in the hostilities, thus virtually requiring the transfer of Presidential authority to local commanders to decide when to use them. Massive deployment of the neutron bomb could induce the Soviets, if they intended to attack NATO, to launch a preemptive nuclear attack. On the other hand, the Soviets could conclude that their forces could overcome the Western powers without recourse to their own nukes and pretend that the war is limited. In that event, the barrages of our neutron warheads would probably decimate far more West Germans and other West Europeans than Soviet tank crews. □

. . . when fears take over

JEROME D. FRANK, M.D.

Whatever the large-scale military, political, economic and social determinants of the outbreak of a war, in the last analysis wars are started by decisions of individuals. Of course, social, economic and political factors always contribute heavily to these decisions, but these are beyond my purview. My presentation will confine itself to consideration of the sources and effects of strong emotions on the thinking and judgment of national leaders and their advisory groups in relation to the outbreak of nuclear war. It will not attempt to consider other relevant psychological forces.

* * *

Until the advent of strategic nuclear weapons, national leaders started wars as a way of protecting or advancing the national interest. War was the major means of securing gains in power, prestige, territory or other resources, or of warding off what was perceived as an imminent threat to the security of the nation.

Because all agree that, regardless of civil defense and increasing sophistication of nuclear arms, a strategic nuclear exchange would be a disaster to the instigator this choice is no longer realistic. Since a full-scale nuclear war could achieve no nation's national objectives, the only motives that would be sufficiently strong to impel leaders of a major nuclear power to launch a strategic nuclear attack would be their perception that the nation's physical survival was directly at stake because an adversary was about to do so, or because they perceived imminent internal economic and political disintegration as more psychologically threatening than probable nuclear destruction.

Since leaders of each side know it would be suicidal to attack the other, a perception of the immediacy of a nuclear attack could only be based on a gross misreading of the adversary's intent. While this could result from a technical breakdown in international communication, a more probable cause of an error of this magnitude would be the distorting effects of strong fear.

Two circumstances under which mutual fear could reach such a pitch are an international crisis in the midst of an uncontrolled arms race, with its repeated temptations to launch a preemptive strike, and the escalation of a war starting with non-nuclear weapons. The war might be between non-nuclear allies of the nuclear powers, or a nuclear power might launch a conventional war against a non-nuclear one to preserve what it regards as its vital interests. For example, one could imagine the United States resorting to violence to preserve the flow of oil from the Middle East.

In the grip of strong emotions a person's thinking becomes more primitive: he perceives fewer alternatives, simplifies issues and focuses exclusively on combatting the immediate threat without considering remote or long-term consequences. Strong emotion also impels to ill-advised actions. Nothing is harder when under emotional stress than doing nothing.

A perceived physical or psychological threat to an individual or group is an especially potent source of rage and fear. The frightening effects of threats to physical integrity are obvious. The power of a threat to psychological integrity—that is, to the self-image of the individual or group—is generally underestimated. The heat generated by a dispute between individuals often becomes greater than the importance of the issue warrants. This is because the antagonists become preoccupied with the need to prevail in order to preserve their self-images. In extreme circumstances, the prospect of destruction of this image may be more intolerable than the prospect of bodily death. In the 1929 crash some financiers chose suicide, even though they still had plenty of money left, apparently because they could not bear to face the implication that their judgment was faulty.

Since the groups to which we belong are psychologically extensions of ourselves, intrusion on the physical or psychological integrity of a group is felt by its members as a direct attack on them. Groups have at least as powerful a need to protect their self-images as do individuals. A powerful motive for escalating the war in Vietnam, for example, was that the United States could not tolerate being perceived as a "weak, helpless giant." Incidentally, a common rationalization is to voice concern about what a nation's allies and potential enemies will think of it, if it yields, rather than what the nation's citizens will think of themselves.

Thus if a conflict is sufficiently bitter, the need of the adversaries to defend their self-images may cause them to continue battling long after the issue that precipitated the conflict has lost its relevance. An historical example is the battle of Verdun in World War I. According to the military historian A. Horne in the New York Times of Feb. 20, 1966, Verdun continued after its "strategic significance . . . had long since passed out of sight; yet the battle had somehow achieved a demonic existence of its own far beyond the control of generals of either nation. Honor had become involved to an extent which made disengagement impossible. "Honor" may be appropriately translated as "masculine self-image."

Contrary to what one might expect, groups may be more prone to rash actions under these circumstances than individuals. To be sure, a group has access to information from more sources and affords opportunities to express more viewpoints, which should help steady its judgments. On the other hand, individuals may be more enraged by a slight to their group than by a slight to themselves. One thinks of the reactions of some Americans to insults to the American flag. A person may be restrained by other group members who do not share his perspective, but in a group

reaction members may reinforce each other or even egg each other on, especially if emotion runs high. This mutual reinforcement is strengthened by what I. Janis has termed "Groupthink." The more a group feels threatened, the more its members are impelled to maintain group solidarity by agreeing with each other and the leader even at the expense of their objective judgments.

We can, perhaps, derive some comfort from the recognition that national leaders would not have reached the top unless they were able to preserve good judgment under stress. Yet the graveyard of history is littered with the remains of societies whose leaders' judgment failed under emotional pressure. As Robert Kennedy indicated in his book *Thirteen Days* on the Cuban missile crisis, even some of the "best and the brightest" can reach a breaking point: "some [of the decision-makers] because of the pressure of events, even appeared to lose their judgment and stability."

A major source of mounting tension—the nuclear arms race—is sparked by the mutual image of the enemy, which emerges when two groups compete for the same goals. In general, enemy images mirror each other: each side attributes the same virtues to itself and the same vices to the enemy. "We" are trustworthy, peace-loving, honorable and humanitarian; "they" are treacherous, warlike and cruel. Of course, the image of the enemy always contains some truth. Although the behavior of the enemy may be motivated by fear more than aggression, nations failing to perceive their enemies as warlike and treacherous would not long survive.

Regardless of its validity, however, the image of the enemy impedes resolution of conflict in many ways, the major one being that it is self-reinforcing: it tends to filter out information that would be inconsistent with it and exaggerate information that confirms it. Thus the mass media play up incidents of an enemy's treachery or cruelty and ignore examples of humanitarian or honorable behavior. Behavior is seen to be in the service of good motives if performed by our side and in the service of bad ones if performed by an enemy. For example, although in wartime both sides always commit atrocities, each side views the other's atrocities as evidence of his evil nature, whereas its own are portrayed as regrettable necessities.

When two adversaries perceive each other as treacherous and implacably malevolent in a world without effective international peacekeeping institutions, their only recourse is to try to deter each other from hostile acts through threat of retaliation. The emotional tensions of deterrence are aggravated by the fact that its effectiveness depends on each side's ability to convince the other of its determination to carry out its threat.

As Walt Rostow stated in the New York Times of June 17, 1964: "credible deterrence in the nuclear age lies in being prepared to face the consequences if deterrence fails—up to and including all out nuclear war." Since all out nuclear war would be an immeasurable disaster, nuclear deterrence puts a premium on bluffing. Former Secretary of State Henry Kissinger wrote, before he entered politics to be sure: "Deterrence depends above all on psychological criteria. . . . For purposes of deterrence a bluff taken seriously is more useful than a serious threat interpreted as a bluff." Thus each nuclear power is faced with the virtually impossible task of trying to make credible an essentially incredible threat.

The result is a never-ending arms race in which the greatest creator of mutual fears is weapons research and development, frantically pursued by each side in the hope of circumventing the other's defenses while perfecting its own.

The faith that an arms race can be "won" technologically is based on the unwarrantable extrapolation of reasonable conclusions, based on experience in one realm, to another in which they are not applicable. Science and technology have indeed solved innumerable problems long considered to be insoluble, such as splitting the

Ruth Adams: "Dr. Frank, do you believe that the American people really appreciate and understand what a nuclear war would mean?"

Jerome Frank: "I don't think people anywhere in the world really appreciate the meaning of a nuclear war because it is a threat that has never existed before and is totally imperceptible. We are beautifully equipped to respond to stimuli that hit our sense organs. We can see a match 500 feet away on a dark night. We can get one quantum of energy from a star that will make us see it. But nuclear weapons do not impinge on our sight or hearing or smell or taste, and we have to realize that the danger requires an enormous effort of imagination. Furthermore, when one is frightened I am certain that the mechanism of denial takes over, and all of us feel somehow that a nuclear war just won't happen."



(left to right) The Bulletin Clock in the hands of Jerome D. Frank, Richard A. Falk, Ruth Adams, and Gene La Rocque.

atom and breaking the genetic code; but all such problems are posed by nature, not by fellow humans. And in this lies their crucial difference from arms races. That is, although problems of military attack and defense present themselves as technological, their ultimate source lies in the intentions of the adversary. Since basically all humans think alike, each solution by one side is promptly counteracted by the other, especially in a world in which technological knowledge is rapidly diffused.

Nevertheless, leaders of technologically advanced nations continue to pursue the will-o'-the-wisp of technological superiority, motivated in part by the fear that a rival might just possibly achieve a breakthrough that would enable it, even for a very brief period, to attack with relative impunity. As a result, the pace of weapons innovation outstrips the negotiating process, so agreements about one weapons system are made obsolete by the emergence of new ones. Even before SALT II, which seeks to control nuclear weapons, is signed, we are being told about charged particle beams and lasers. Thus the more frantic the pace of research and development, the more difficult it becomes to reach arms control agreements, and the greater the mutual fear.

Mutual fear and hate are enormously heightened at the point when deterrence fails and war supervenes. The prospect of defeat now becomes a particularly potent physical and psychological threat, and the time available for decisions is drastically shortened. The dangers of errors of judgment are then magnified and pressures toward escalation become irresistible. This has been true all through history. Homer's *Iliad* says of Strife, the War-god's sister: "At first she seems a little thing, but before long, though her feet are still on the ground, she has struck high heaven with her head."

Ultimately the only guarantee against the outbreak of nuclear war would be a world order with effective institutions for prevention of all wars. A psychological prerequisite to the achievement of this distant, perhaps unattainable, goal would be a sense of world community among all peoples, transcending national loyalties. This could be fostered by use of technological innovations such as instantaneous worldwide electronic communication via satellite to promote intercultural understanding and impede formation of the enemy image. More effective would be institution of international cooperative activities such as the International Geophysical Year to achieve goals all nations desire but none can achieve alone. Examples would be control of pollution of the biosphere, improvement of weather forecasting, and more rapid exploration of outer space and the oceans. Social psychologists have shown that cooperation toward such "superordinate goals" powerfully counteracts group antagonisms.

From a psychological viewpoint, immediate measures to forestall the outbreak of nuclear war should place high priority on those that would help to reduce mutual mistrust between nuclear powers. Right now, two promising tension-reducing steps would be ratification of SALT II and the Comprehensive Test Ban. The main psychological benefit from SALT II is not that it would slow the arms race, which it would not, but that it would codify it and decrease the weapons options of both Russia and the United States, thereby reducing mutual uncertainty about the other's future actions.

More promising is the Comprehensive Test Ban since this would check the runaway development of new weapons systems, the main source of mutual fear.

Through negotiation national leaders learn methods of resolving conflicts without war, and as successive agreements are kept by both sides, mutual trust grows. Each successful negotiation thus increases the chances for success of the next one, progressively enhancing mutual trust.□

Comments



I. F. Stone: "The delusion of American policy is that a successor government to the Shah might refuse to sell the West its oil. Does Mr. Falk think that a successor regime, democratic especially, would be less willing to sell its oil to the West, to the only customer available, than the Shah?"

Richard Falk: "There are two sets of reasons why a successor government is perceived as a great threat. One is that any successor government would not sell oil to South Africa or Israel. Second, any successor government is perceived as incapable of really sustaining itself in control very long and what the United States is worried about is losing control."

I. F. Stone: "This is the delusion which led the British government in the 1920s and the American government later to deny the people of Iran the democratic liberties we talk so much about and prize so highly: the idea that unless there is a corrupt military dictatorship, or a king who can be bribed and bought, that somehow no one is going to deal with us. Now, of course, the oil companies prefer that kind of a man to deal with, but it is nonsense to think that oil would not be available. As far as Israel and South Africa are concerned, they are very minor customers. In the world market there are a million ways to get around the embargo, any embargo, as we have seen in the case of Rhodesia."



George Wald: "There has been talk about Iran and how they might stop sending the oil where it is wanted. You must not leave out another consideration. Iran has been our biggest customer of arms in the past years. We have already sold them $17 billion worth of arms."

Richard Falk: "I agree with what George Wald has brought to this discussion because I think it is one of those fundamental reinforcing elements that keeps us going on the wrong path, and makes it extremely difficult for political leadership to shift. It makes it extremely difficult for the public to be told the truth about deteriorating security. It certainly is true that one of the things that any successor government in Iran would do is to stop the Iranian national tragedy of filling up their country with weaponry they can't use or even operate without 45,000 Americans there to teach them how to keep the weapons in operational use."

George Kistiakowsky: "I would like to support what Mr. Salisbury has said. Last summer I had the opportunity to talk to a number of Soviet intellectuals at a conference and what they said in private conversations was that they are afraid of the war with China. They see China as the aggressor preparing to take back all those lands north of the border that Imperial Russia not very gently took from China 150 years ago."



Jules Feiffer: "Every time I come to Washington, I fall prey to a case of galloping insiderism. Thus, I would like to know what the nature of the debate is within the Administration because we the public get mixed signals. There is all sorts of stuff about the neutron bomb, about the Soviet buildup, about the death ray."

George Kistiakowsky: "The fundamental problem is the strong forces, financed to a large extent by military contractors, who for several years have been trying to scare the American people. Any of you who have seen that extraordinary film called the *Price of Peace and Freedom* will understand what is being sold to the public. One thoughtful Senator said to me that when he goes home and talks to people he finds everybody scared that the United States is weak, and that the Soviets are way ahead of us. We should say loudly and clearly that we are a strong nation; we have plenty of weapons; we have guts and therefore we need not be afraid."

Peter Sharfman (Office of Technology Assessment, U.S. Congress): "If you look at Soviet policy today, it bears a certain resemblance to the U.S. policy of 20 years ago: the building up of a military machine beyond what is obviously necessary, and intervening here and there in the world for reasons that are not totally clear. At the same time, the Soviet economy is not growing as fast as it used to. One could argue that a similar situation led the United States into Vietnam. One wonders whether this may lead the Soviet Union into biting off more than it can chew, but only the next time around there might be greater escalation."

Richard Falk: "I agree. There is no question that the Soviet Union is either trying to neutralize our role in the Third World or playing a comparable role to the one the United States played in the post-World War II period. It may be doubtful which motive is the dominant one but combined with the American decline economically and politically, it seems to me to invite some kind of confrontation and the confrontation is likely to center on resources rather than ideology. And the most vulnerable place in the world system is the struggle for resources and the most critical resource is obviously oil."

Harrison Salisbury: "I want to add a word. The Chinese several years ago began to talk about the Soviet policy as being sort of a revival of John Foster Dulles'. I do not know how accurate that may be but it does convey a certain ingredient which does exist in Soviet foreign policy today. There is a strong limiting factor so far as expensive Soviet adventures in Africa and Asia are concerned. The Soviet Union does not have the means that the United States had during the era of Eisenhower and Dulles. The Soviet GNP is about half that of the United States. The Soviet government gets flak from its own people when they engage in costly and, as it is seen by the Soviet citizen, unprofitable ventures such as Cuba and Africa. Soviet citizens regard these ventures as unproductive and keeping butter off the market in Moscow."

Leo Szilard: His version of the facts

From that point on secrecy was on.

The Washington meeting was followed by the most curious period in my life. We heard nothing from Washington at all. By the first of February [1940] there was still no word from Washington—at least none that reached me. I had assumed that once we had demonstrated that in the fission of uranium neutrons are emitted, there would be no difficulty in getting people interested; but I was wrong. Fermi didn't see any reason to do anything, since we had asked for our money to buy graphite and since we hadn't yet gotten the money. He was interested in working on cosmic rays. I myself waited for developments in Washington, and amused myself by making some more detailed calculations on the chain reaction of the graphite-uranium system.

It is an incredible fact, in retrospect, that between the end of June 1939 and the spring of 1940, not a single experiment was underway in the United States which was aimed at exploring the possibilities of a chain reaction in natural uranium.

Late in January or early in February 1940 I received a reprint of a paper by Joliot in which Joliot investigated the possibilities of a chain reaction in a uranium-water system. In a sense this was a similar experiment to the one which Anderson, Fermi, and I had carried out and published in June. However, Joliot's experiment was made in a different set-up, and I was able to conclude from it what I was not able to conclude from our own experiment, namely, that the water-uranium system comes very close to being chain-reacting, even though it does not quite reach this point. However, it seemed to come so close to being chain-reacting that if we improved the system somewhat by replacing water



with graphite, in my opinion we should have gotten over the hump. . . .

I then went to see Einstein again in Princeton and told him that things were not moving at all. I said to Einstein that I thought the best thing I could do now was to go definitely on record that a graphite-uranium system would be chain-reacting, by writing a paper on the subject and submitting it for publication to the *Physical Review*. I suggested that we reopen the matter with the government, and I proposed to take the position that I was going to publish my results unless the government asked me not to do so and unless the government was willing to take some action in this matter.

Accordingly, I wrote a paper for publication and sent it to the *Physical Review* on February 16. I brought the paper over to Pegram, who was somewhat embarrassed because Fermi was out of town and Pegram did not know what action he should take. However, he said that he must take some action, so he went to see Admiral Bowen in Washington, who Pegram thought might take some interest because, after all, atomic energy might be used for driving submarines.

On the basis of a conversation which I had with him, Einstein wrote to Sachs, and Sachs wrote again to the President. The President replied that he thought the best way to continue research would be to have another meeting of the Uranium Committee. . . .

In the spring of 1940 we were advised that the money, the $6,000 which the committee had promised us, was available. We bought some graphite and Fermi started an experiment to measure the absorption of this graphite. When he finished his measurement the question of secrecy again came up. I went to his office and said that now that we had this value, perhaps the value ought not to be made public. And this time Fermi really lost his temper; he really thought this was absurd. There was nothing much more I could say, but next time when I dropped in his office he told me that Pegram had come to see him, and Pegram thought that this value should not be published. From that point on secrecy was on. . . .

After reorganization in Washington, which put the Uranium Committe under Dr. Vannevar Bush's committee, Columbia University was given a contract in the amount of $40,000 to develop the Fermi-Szilard system. On November 1, 1940, I was put on the payroll of Columbia University under this contract. Since I was instrumental in inducing the government to assume expenditures for exploring the possibility of setting up a chain reaction, and with a view to the possibility that our efforts might come to nothing, it was deemed advisable to set my salary at a low figure, i.e., $4,000 a year. . . .

Somehow we did not seem to get the things done which needed to be done

. . . While up to this point we had suffered from the lack of official recognition, during this period we were suffering from having official recognition. Things would have dragged on in a most unsatisfactory way had not the British recognized that it is possible to separate a sufficient quantity of uranium-235 to make atomic bombs. Anybody could have recognized this fact. We knew two things: how much uranium-235 could be separated with a reasonable industrial effort, and how much uranium-235 it took to make a bomb. Urey, at Columbia University, and the Office of Naval Research worked on the separation of the isotope uranium-235, while Fermi and I worked on the nuclear properties of uranium. It so happens that I actually measured the cross-section of uranium-235 for medium-velocity neutrons in the first half of 1939. From this I could have computed how much uranium-235 it takes to make a bomb. The amount seemed fairly large, and I did not know that it was possible to separate such quantities of uranium-235. Urey's contract specified that he was not supposed to discuss his results with Fermi and me, who were not cleared. Therefore we were not able to put two and two together and come out with a simple statement that bombs could be made out of reasonable quantities of uranium-235.

In Britain there were a number of German refugees such as Simon, Peierls, and Frisch, who at the beginning of the war were not permitted to work on anything of military significance, and therefore took to working on uranium. Simon was interested in the separation of uranium-235; Frisch and Peierls were interested in nuclear properties. Nothing prevented them from talking to each other. They put two and two together and they informed the British government of the possibility of making uranium-235 bombs with quantities of material that were industrially available. The British government informed the American government. So for the first time our attention was directed to the problem of making atomic bombs rather than merely to the problem of making a chain reaction. . . . For the first time the government realized that our project was important.

Oliphant came over from England and attended a meeting of the Uranium Committee which neither Fermi nor I was permitted to attend. He realized that something was very wrong and that the work on uranium was not being pushed in an effective way. He travelled across this continent from the Atlantic to the Pacific and disregarding international etiquette told all those who were willing to listen what he thought of us. Considerations other than those of military security prevent me from revealing the exact expressions which he used. If Congress knew the true history of the atomic energy project, I have no doubt that it would create a special medal to be given to meddling foreigners for distinguished services, and Dr. Oliphant would be the first to receive one.

He discussed his concern with E. O. Lawrence, who in turn approached Compton, and as a result of this agitation it was decided to reorganize the project. A. H. Compton was supposed to be in charge of setting up a chain reaction with a view to producing plutonium. Mr. Urey was supposed to be put in charge of separating uranium-235 by the diffusion method, and Lawrence was supposed to be in charge of separating uranium-235 by [the electromagnetic] method. Actually reorganization took place around . . . January 1942. At that time the project from Columbia University was moved to Chicago, and all of the grant funds were put at



Sir Robert Watson-Watt and Leo Szilard at an early Pugwash conference.

the disposal of the [Chicago] project. However, even now the authority to purchase materials was not given to the project.

While negotiations for materials formerly had to go through the Bureau of Standards, now negotiations for the purchase of materials had to go through [Eger V.] Murphree of Standard Oil of New Jersey. This division of authority hampered us through the first half of 1942. In spite of this, somehow A. H. Compton, director of the project, managed to make arrangements for obtaining uranium purified in the right way so as to [free?] uranium from the neutron absorbing substances which the older way of preparing it did not remove. As purer-grade uranium was obtained and pure uranium metal began to come in, it became clear that a self-sustaining chain reaction would be achieved. This much was clear to most of us, including A. H. Compton, in the spring of 1942. And on December 2, 1942, the chain reaction was actually started at Stagg Field on the campus of the university. There was a crowd there and then Fermi and I stayed there alone. I shook hands with Fermi and I said I thought this day would go down as a black day in the history of mankind.

Fermi is a genuine scientist. There is no greater praise I could bestow on anyone. The struggles for our times do not affect him very much, and he is no fighter. Some people hold this against him; they have no right to do so in my opinion. During the war Fermi did whatever was expected of him. He gave the best advice he could and never lost his sense of proportions. He, like all of us, wanted us to win the war, but somewhere deep in his heart he knew that it did not really matter whether we won or lost, and that a hundred years from now people would not find it easy to understand what it was we all had gotten so excited about. . . .

It is impossible truthfully to record the early story of the atomic bomb without hurting the feelings of some of those who were involved. I am sorry about this. If it were not for my addiction [to the truth] I could temper the truth with kindness, at least more so than it is possible for me to do in the circumstances. I do not wish to say of course that other accounts of the "early history," those written in the past or those which may be written in the future, are less truthful because they are different from mine. In 1943 Hans Bethe from Cornell visited in Chicago and we discussed the work conducted there under the Manhattan Project in which I was involved. The things that were done and even more the things that were left undone disturbed me very much particularly because I thought (quite wrongly as we now know) that the Germans were ahead of us. "Bethe," I said, "I am going to write down all that is going on these days in the project. I am just going to write down the facts—not for anyone to read, just for God." "Don't you think God knows the facts?" Bethe asked. "Maybe he does," I said—"but not *this* version of the facts."

Abbreviated excerpts from

Leo Szilard:
His Version of the Facts

Edited by Spencer R. Weart and Gertrud Weiss Szilard

The MIT Press, 28 Carleton Street, Cambridge, Massachusetts 02142
1978, 259 pages, $17.50



(top) West end of Stagg Field, University of Chicago, as it looked during World War II. The first sustained nuclear chain reaction was achieved with Chicago Pile-1, built in the squash courts under the West Stands of Stagg Field. Some of the 'first pile' scientists: Back row, left to right, Norman Hilberry, Samuel Allison, Thomas Brill, Robert G. Nobles, Warren Nyer, and Marvin Wilkening. Middle row, Harold Agnew, William Sturm, Harold Lichtenberger, Leona W. Libby, and Leo Szilard. Front row, Enrico Fermi, Walter H. Zinn, Albert Wattenberg and Herbert L. Anderson.

Documents

Memorandum from Szilard to Alexander Sachs, August 28, 1940.

The production of a chain reaction in uranium in circumstances which are suitable to be utilized in an engine capable of driving a naval vessel is a task of considerable complexity. This task cannot be carried out by a loose cooperation of various committees and universities. It requires planning, the preparation of experiments six months and occasionally one year ahead, the gathering of a group of physicists prepared to collaborate for a number of years, whose loyalty has to be with this work rather than with the individual teaching institutions with which they happen to be associated. At present we may assume that the work carried out at Columbia University will be supported by Dr. Bush's committee, but it is unlikely that this complex task can be carried out at a single university where the available space and the necessity of maintaining the routine work carried out by the department will naturally limit the speed at which the work should be carried out. A loose cooperation between various universities can be anticipated and may to some extent remedy the situation, but surely this is no way of obtaining quickly the desired results. The existing committees both by virtue of their composition and by virtue of their structure can hardly be expected to fulfill the function which is required. This is fully borne out by the experience gathered during the last 10 months. . . .

In spite of the increasing favorable reaction of the Government representatives little headway was made during the past 10 months, either towards organizing and financing the necessary experiments or towards securing an adequate supply of uranium ore for the future from the Belgian Kongo, which is the most important source of highgrade uranium ore.

At present it may be assumed that the experiments which will be carried out at Columbia University will find financial support through Dr. Bush's committee, but if each necessary step requires 10 months of deliberation then obviously it will not be possible to carry out this development efficiently. Since April of this year it has been known that work on uranium is proceeding in Germany in great secrecy and on a very large scale in two of the Kaiser Wilhelm Institutes under the auspices of the German Government. This is precisely what was predicted by Prof. Einstein in his above mentioned letter of September last year. . . .

In order to insure that the task before us is carried out with the efficiency of a going enterprise it is proposed that it be entrusted to a non-profit organization which is formed for the purpose. The scientists responsible for devising this project and who are familiar with the various aspects of this complex material ought to be included in the executive and ought to be in direct touch with Dr. Bush and such other government representatives as are interested in the details of the project. Large scale experiments ought to be carried out as a joint enterprise of this organization and Columbia University and such other universities as may be willing to collaborate and to put up required space and other facilities. It would be the responsibility of this organization:

1. To see to it that all necessary experiments be carried out at one place or another and

2. To see to it that all necessary materials be available for such experiments in the required quantity and quality.

3. To find out in what form if any collaboration with industrial organizations such as for instance Westinghouse, General Electric and Dupont is desirable and possible, and if desirable to establish such collaboration.

4. To maintain contact with the Canadian and U.S. producers of uranium and to stimulate if necessary an expansion of the production.

5. To advise the government in general and the Secretary of the Navy in particular of the developments and to prepare the ground for gradually transfering the experience acquired to the Navy at the appropriate time.

It may be mentioned that this form of organization has been repeatedly discussed at previous meetings and an option strongly in favour of it has been expressed by Prof. Einstein in a letter addressed to Dr. Briggs. . . .

Letter from Szilard to Vannevar Bush, May 26, 1942.

I am taking this step of writing to you because I am concerned about the slowness of the work on unseparated uranium. In the past those who had originated this work did not ask to be consulted on matters of organization which had vitally affected their work. This, I now believe, was a mistake on our part. If we had presented to you our views on such matters perhaps we might have been able to explain to you our difficulties and you might have been able to remove them.

At present the main source of our troubles seems to lie in a division of authority along the wrong lines. This was the cause of most of our difficulties from the start . . .

Excerpt from Szilard memorandum on proposed conversation with Bush, February 28, 1944

Psychological Situation of the Scientists. In order to understand this situation one has also to understand the psychological reaction of the scientists which is a very important part of the general picture. The trouble started when, in June 1940, it became evident that it would be impossible to have a body who could speak in the name of the scientists who know most about this field. At that time nobody knew more about the potential possibilities of the chain reaction in uranium than Fermi, Wigner, and myself. At first when we were excluded from the committee which Dr. Urey tried to organize in June 1940 , . . some of our colleagues argued that it would be possible for us to make our voices heard through the

mouths of some of our American colleagues.

The attitude taken towards the foreign born scientists in the early stages of this work had far reaching consequences affecting the attitude towards the American born scientists. Once the general principle that authority and responsibility should be given to those who had the best knowledge and judgment is abandoned by discriminating against the foreign born scientists, it is not possible to uphold this principle with respect to American born scientists either. If authority is not given to the best man in the field there does not seem to be any compelling reason to give it to the second-best man and one may give it to the third- or fourth- or fifth-best men, whichever of them appears to be most agreeable on purely subjective grounds.

Immediately after the dissolution of Urey's committee, Mr. Wigner wrote to Dr. Briggs asking to be relieved from collaborating in the uranium work. He did not take an active part in this work until much later. Since Mr. Wigner was a sort of symbol for those who were convinced of the necessity of collaborating in this field with the U.S. government, the fact that he was discouraged was an incalculable loss at that time.

When in November 1940 contracts were placed with Columbia University, it was specified that Fermi and I not be given knowledge concerning the development of the centrifuge supported by the Navy. Mr. Fermi was visibly affected by this and he has from that time on shown a very marked attitude of being always ready to be of service rather than considering it his duty to take the initiative. It so happens that early in 1940 I had given some thought to methods of maintaining a counter current of uranium hexafluoride in a centrifuge which I discussed with Urey and after November 1940 Urey was not free to continue these discussions. I felt so discouraged by this that I failed even to work up and write down some earlier nuclear measurements which Zinn and I made in 1939. These measurements gave information on the fission cross section of U^{235}. Had our value been known to Urey and had we been aware that separation of the uranium isotopes would receive adequate support, we certainly would have gone through the simple calculations. . . .

Our British colleagues who visited this country in 1941 fully realized the harm done to the American work through this compartmentalization and freely expressed themselves to this effect. Their attitude was summed up by G. P. Thompson who said something like this: I believe that the Government may succeed in keeping most of the work on uranium secret from the men who do the work—but will it succeed in keeping any of it secret from the Germans?

It would, however, be a mistake to think that keeping pertinent information from physicists is an isolated phenomenon limited to the foreign-born. That was the case only when the trouble started; later information was more and more kept from Dr. Urey who is American born, a Nobel prize winner, and from other Americans who have a key position in this work. Among the American Nobel prize winners Dr. Urey has been perhaps pushed around more than any of the others. . . . Some excuse can always be found in every individual case, but the net result is that the scientists are annoyed, feel unhappy and incapable of living up to their responsibility which this unexpected turn in the development of physics has thrown into their lap. As a consequence of this, the morale has suffered to the point where it almost amounts to a loss of faith. The scientists shrug their shoulders and go through the motions of performing their duty. They no longer consider the overall success of this work as their responsibility. In the Chicago project the morale of the scientists could almost be plotted in a graph by counting the number of lights burning after dinner in the offices of Eckhart Hall. At present the lights are out.

Secrecy. I wish now to discuss what gain in secrecy is achieved by withholding information from those scientists who have shown initiative in the past and who would show initiative at present if they were not frustrated in their work. There is a unanimous opinion among the scientists that there is no appreciable gain in secrecy by withholding information from the key men. All those men have a long record which is known to many of their colleagues. Many of them have known each other for over 20 years. It is inconceivable that any of these scientists should disclose technical information to the enemy. As a matter of fact, there is not a single case in the history of the world on record where a scientist has betrayed the trust of the Government for which he worked in wartime.

That secrecy is important was recognized by many of us in March 1939 and there is a long record of documents showing that we did our best to get the support of the Government for organizing secrecy and that it was the representatives of the Government who failed to realize the importance of secrecy at that time, just as later on they failed to realize the harm due to secrecy in the wrong place.

In the circumstances the compartmentalization imposed on the scientist is considered by them as unjustified and the argument that it is necessary for reasons of security is rejected by them.

At present the responsibility for secrecy rests with the Army and the methods for safeguarding secrecy are essentially the routine methods which usually are applied by the Army to developments very different from the character of the uranium projects. Leaks at present are numerous and the nature of some of those leaks is well known to the scientists. Few of us doubt, for instance, that the Germans know the location of our sites, which is very regrettable. No information of a technical nature is, however, leaking out through the scientists who have key positions in this work, at least none of us believes that leaks of this nature occur. . . . □

JOHN DOWLING reviews

War Without Winners

Produced by Harold Willens, directed by Haskell Wexler, sponsored by the Center for Defense Information (122 Maryland Ave. N.E., Washington, D.C. 20002). Distributed by Films Incorporated, 733 Greenbay Rd., Wilmette, Ill. 60091. 16 mm or ¾" videocassette, color, 27.5 min. Price: $300 purchase; $35 rental.

Most nuclear war films are an appeal to fear. *War Without Winners* is a fresh and delightful appeal to reason. Fresh, because it looks at arms control from a different point of view, that of the common people. Delightful, because the common people interviewed, though not cognizant of the complexities and linkages of the arms race, see the overriding insanity of the arms race and simply say: "The king has no clothes."

War Without Winners establishes its appeal-to-reason theme via President Eisenhower's moving speeches on world peace. Eisenhower's words are interwoven with interviews of Russians and Americans on the street, and of arms control specialists.

The interviews with the common people are conducted in the most outrageous situations. One is done at a railroad crossing with bells clanging; several are in factories or busy streets with loud background noises; and one interview is even interrupted by a phone call and resumed later. The objective is to maintain an air of spontaneity, but it does put a strain on the viewer.

In retrospect, the clamor and ridiculousness of the interview surroundings are saved by what the people say. For example, an old crotchety abrupt Russian woman: "I want to say to the American people that they must fight together with us against the atomic bomb, for peace, that's all." A young American boy: "And, I might ask him a question like, does your father own a 50-megaton bomb? Really, if he does, could you tell him to throw it away?" A Russian ballerina: "If war ever came, everything would be destroyed. And, of course, nothing would become of me. And all I'm hoping for is to dance." And finally, a woman with a baby on the Washington Metro: "If you build a lot of weapons, then you are saying yes, it's possible to have a nuclear war and maybe okay, maybe somebody can win a nuclear war. Who could win a nuclear war? No more children, right? That's the end."

The interviews with arms control specialists such as Herbert Scoville, Paul Warnke, George Kistiakowsky, and Admiral Gene La Rocque (Director of the Center for Defense Information) provide some pertinent facts and figures on arms race issues. While these interviews do give some numbers and data they do not try to overwhelm the viewer or to lie with statistics.

There are two striking editorial "statements" by the film's producers. One is made when some defense workers are interviewed, and they all see the great need for money for defense. But the film-maker also gives the other side a chance to make a statement, and the effect is to discount the interviews with defense workers as obviously biased. The other "statement" is the very cleverly done sequence where Eisenhower is giving his famous military-industrial complex speech. Along with his words one hears *The Star Spangled Banner* playing in the background while corporate ads out of something like *Aviation Week and Space Technology* are displayed on the screen. The militaristic, sexual, and machismo character of these ads is startling. Many viewers will conclude that there is real money to be made in the arms race and that's why we are in it.

War Without Winners is an effective counter to the hawkish propaganda of films like *The Price of Peace and Freedom* (*Bulletin*, March 1977, 57-58). Though *War Without Winners* touches on basic aspects of the arms race, its primary purpose is not to give a substantive treatment of the issues but rather to get people to think about them. To this purpose La Rocque says: "You need information. For many years, we have been responding to fear. It is now time to respond to reason. Write to me."

The first two sentences of this review paraphrased La Rocque's appeal. They bear repetition because they convey the thrust of *War Without Winners*. I would also add a thought prompted by the two touching interviews I have quoted, one with the ballerina and the other with the woman on the Metro. Most nuclear films are an appeal to fear. *War Without Winners* is a fresh and delightful appeal to reason. It makes you want to stop building bigger and better weapons and start dancing and living.□

John Dowling is professor of physics at Mansfield State College and film editor of the American Journal of Physics.

GEORGE SILVER reviews

Medicine and the Reign of Technology
by Stanley Joel Reiser
Cambridge University Press, 1978
328 pages, $14.95

Medicine's gradual absorption into the realm of technology, resulting in increased competence and diminished civility, is no sudden development. The value and interest of Reiser's book lies in the precise detailing of the steps that led from the medicine of empiricism, speculation, and leaps of imagination to the medicine of diagnosis based on information derived by more or less precise instruments. As a historian, Reiser is naturally interested in the historic elements of the story. But in the telling, it becomes clear that much of what we most deplore in modern medical practice is directly related to the advances that made

possible the modern medicine we admire.

He writes in his introduction,

". . . modern medicine has now evolved to a point where diagnostic judgments based on 'subjective' evidence—the patient's sensations and the physician's own observations of the patient—are being supplanted by judgments based on 'objective' evidence, provided by laboratory procedures and by mechanical and electronic devices. . . . The reliability of the evidence thus produced is discussed, as well as the hazards involved in its unquestioning acceptance."

It is a good book and well worth studying. He seems to mark the beginning of the new era with the French physician René Laënnec and his invention of the stethoscope. So it is no haphazard accident that this instrument has come to mark our physicians today as the caduceus did the acolytes of Asclepius.

His weakest chapter is the analysis of the effects of specialism. Itself a child of technology, specialism has eroded the larger part of the physician's traditional and still necessary (yet sadly neglected) role—patient care.

Perhaps it is the love affair we Americans seem to have with technology that leads Reiser to spare the medical profession from stronger criticism. The book does illustrate how much we are suffering the consequences of too much immersion in technology; refinements in skill are not reflected in breadth of purpose. As Sir Richard Livingston pointed out, a technician is one who knows everything about his job except its ultimate purpose and social usefulness.

One of the more important lessons to be drawn from this presentation is what it means for those parts of the world just beginning to catch up with the technological revolution. Frank Press, in a thoughtful paper in *Science*, notes that while productivity growth is slackening in the developed countries, it is rising in the developing ones. Dependence on technology is bound to increase proportionately. It is not unlikely that the health and medical care systems that are developing in these countries may be caught in the same trap in which we have been caught—confusing technological advance with improvement of medical care services. It is hard to describe the proper line toward which we should be trying to improve and apply technology, or the line beyond which we should not be proceeding for fear of entering into self-serving, expensive, and purely mechanical activity. Developing countries, even less than we, can ill afford the luxury of unlimited application of technology.

René Dubos has accused the scientific community of abdicating moral responsibility to consider humanistic application and research consequences. Reiser underlines this through its effect on the doctor:

"The historical experience of medicine thus reveals diagnostic technology to be a double-edged sword. Its use can enlarge the doctor's knowledge of disease, but it can also erode his confidence in his ability to make independent judgments. . . . After each move to a new stage and new techniques, skills in using the old techniques have declined, with the resulting sacrifice of the unique insights they provided. . . . Accuracy, efficiency and security are purchased at a high price when that price is impersonal medical care and undermining the physician's belief in his own medical powers."

For the developing countries, technology may indeed be the "poisoned gift." Reiser's book, with its thoughtful look into the growth of scientific advance in the developed world holds an important message for the developing world.□

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NICOLE BALL reviews

The Atmosphere: Endangered and Endangering
edited by William W. Kellogg and Margaret Mead
U.S. Department of Health
GPO, 1977
154 pages, $2.50

Earth's Aura
by Louise B. Young
Alfred A. Knopf, 1977
305 pages, $12.95

A Change in the Weather
by Fitzhugh Green
W.W. Norton, 1977
248 pages, $9.95

Regimes for the Ocean, Outer Space and Weather
by Seyom Brown, Nina W. Cornell, Larry L. Fabian and Edith Brown Weiss
The Brookings Institution, 1977
257 pages, $10.95; $4.50, paper

Over the last decade, an apparent increase in climate-induced "natural" disasters (such as the drought in the Sahel) and a growing awareness of human-related environmental degradation (like the debate on the effects of burning fossil fuels) have helped to focus public and governmental attention on the relationship between people, the societies they construct and the atmospheric environment which surrounds them. Each of the books reviewed here can be seen as a response to this growing awareness of the possiblity of altering climate and weather, either consciously or inadvertently. Those by Young, Green and the Brookings group are specifically for the general public while the Kellogg and Mead volume is directed more toward policy-makers. However, the latter is by no means difficult to follow and if anyone were to choose just one of these books to read, it should without a doubt be the one edited by William Kellogg and Margaret Mead.

The Atmosphere: Endangered and Endangering grew out of a conference on the earth's atmospheric environment sponsored by the Fogarty International Center in October 1975 which was seen as "part of a continuing dialogue between scientists and policy-makers." It identified the incompleteness of scientific information as one of the major problems in attempting to make policy decisions relating to the impact of human activities on the amosphere. "In many cases the time for significant changes to occur appears to be shorter than that required to develop a satisfactory scientific understanding of the major factors involved." In view of this and since "it is certain that indefinite growth in the level of human interference with natural processes will result in a number of clearly discernible effects," policy decisions will increasingly have to be made without all the desired scientific information. For this reason, Mead argues that scientists must agree on "margins of danger concerning environmental hazards" and on "minimal statements . . . about the uncertainty and risks of proceeding in a certain way" in order to aid policy-makers in the policy formulation process.

The book is composed of summaries of conference papers and discussions dealing with the atmosphere and the impact of human activities on it, the benefits and dangers of environmental change and the possibilities for rational management of the atmosphere. To aid "the busy executive or legislator," the conclusions are summarized at the beginning of the book. A useful bibliography is included, as is a glossary to aid the nonexpert who is likely to be unfamiliar with such technical terms as "almost-intransitivity" or "sensible heat transport."

Perhaps one of the most important thoughts that readers of the Kellogg and Mead book should take away with them is that of time-scales. The earth's biological system, including the atmosphere has evolved

The Global Predicament

Ecological Perspectives on World Order

Edited by
David W. Orr and Marvin S. Soroos

Foreword by
Richard A. Falk

"A remarkably fruitful overview. . . . Should be required reading for everyone, but in particular for physicists and engineers, biochemists, marketplace economists, business leaders, and politicians, military planners, and civil servants."—*Harold and Margaret Sprout, Princeton University*

Oceanic pollution, climate disruption, and resource depletion will require new forms of institutions and fundamental changes in the prevailing concept of national sovereignty. The seventeen essays in this collection explore the political aspects of a variety of global ecological problems, focusing on the international political system and on those environmental issues that transcend political boundaries. The authors examine specific international ecological problems and the more general need for equitable resource management. These essays lay the foundation for an urgently needed model of global politics to cope with a world of natural limits.

Approx. 350 pp.

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extremely slowly over millions of years, always seeking to maintain or regain equilibrium. Human interference in the earth's biological system occurs much more rapidly. Today, the natural environment is being required to react to changes more quickly and on a larger scale than ever before. It is simply not known whether the environment's repair mechanisms will be able to keep pace with man-made interventions and perturbations or whether the disequilibrium will eventually become so great that ecological collapse will occur.

"Unless the peoples of the world can begin to understand the immense and long-term consequences of what appear to be small immediate choices—to drill a well, open a road, build a large airplane, make a nuclear test, install a liquid fast breeder reactor, release chemical wastes . . . the whole planet may become endangered."

Earth's Aura is a description of the different elements which compose the earth's atmosphere and create its weather and climate. Young traces man's first attempts at understanding atmospheric phenomena (such as the composition and behavior of clouds, atmospheric pressure) and the greater knowledge made available through the technological advances of the twentieth century (such as the discovery of the jet stream, cosmic rays). Some of the negative side effects of human activity (such as air pollution, possible destruction of the ozone layer) are also explored. In addition, there is a long bibliography of largely nontechnical works which should be of interest to the general reader. Indeed, as a book for the general public, *Earth's Aura* is highly recommended. It is extremely easy to read and, at the end, one is left with a strong appreciation for "the planet as a whole—a single finely integrated system to be guarded and cared for."

At first glance, *Earth's Aura* and *A Change in the Weather* seem to be ideal companion volumes, with Young explaining how the atmosphere works and Green discussing the pro's and con's of weather and climate modification. However, *A Change in the Weather* is extremely disappointing. It lacks the thoughtfulness which characterizes both the Young and the Kellogg and Mead books. While it is pointed out that human intervention in the earth's land, sea and air environments may cause unwanted and possibly harmful side effects, the general tone of the book is one of optimism: on balance, the outcome of programs to modify weather and climate will be beneficial. There simply is no guarantee that this will be the case. In fact, it seems highly possible that the more we seek to alter the atmospheric system, the greater the likelihood that serious disequilibrium will result.

Furthermore, many of the problems addressed by environmental modification programs are social and political in nature. Social and political solutions, not technological ones, are appropriate. For example, hurricanes in the United States are causing increased property damage annually. And because of the tendency of Americans to locate communities on low-lying land, it is feared that the death toll in future tropical storms will rise significantly. To absolutely forbid construction in certain areas and seriously discuss the necessity of population control would be politically unpopular. However, it would be a better long-term solution and very likely a more ecologically sound one than to pour millions of dollars into tinkering with environmental systems—the functioning of which we understand only partially. Nonetheless, Green urges increased expenditure on hurricane abatement research as means of dealing with the short-term damage that hurricanes produce.

Regimes for the Ocean, Outer Space and Weather, which was produced for the Brookings Institution, seeks to acquaint the general reader with the possibilities which exist for the management of the ocean, outer space and the weather. Essentially, the United States is urged to back greater international accountability in the use of these areas, even if some short-term economic disadvantages were to result from such a policy. This volume is a good introduction to the topic. However, the section on weather management is the shortest and if the reader is not interested in questions of ocean and space management, then the Kellogg and Mead book is probably a better investment. The latter also devotes 20 pages to a discussion of the management of the atmosphere which largely parallels that in the Brookings volume. □

Nicole Ball is an independent researcher who lives in Ithaca, New York, and who writes on the socio-economic and political causes of "natural" disasters.

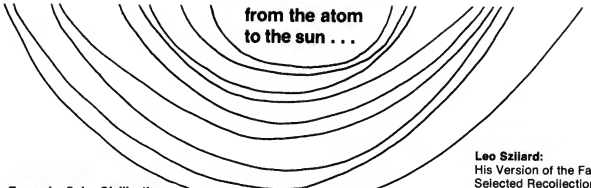
HENRY KELLY reviews

Principle Conclusions of the American Physical Society Study Group on Solar Photovoltaic Energy Conversion,
Henry Ehrenreich, Chairman

American Physical Society, 1979
189 pages, $5.00

The report of the American Physical Society's study group on photovoltaics, jointly funded by the Department of Energy and the Office of Science and Technology Policy, has appeared at a time when a number of critical decisions will be made about the U.S. photovoltaic program.

The APS report provides a thoughtful review of research opportunities in photovoltaics (particularly in the fields of semiconductor/liquid interfaces, electrochemistry and photochemistry) and suggests a useful set of research priorities. Unfortunately,



Toward a Solar Civilization
edited by Robert H. Williams
The thirteen articles in this volume cover the diverse technological prospects and the practical economic considerations involved in the development of solar energy as a significant source of our civilization's future needs. The articles are all accessible to readers with no specific technical background in the energy field but who do have an interest in the technoiogical aspects of this expanding venture. Written by prominent researchers and policy analysts, the articles originally appeared as a series in the *Bulletin of the Atomic Scientists* (1975–1977).
$12.50

Proceedings of the Atoms for Peace Awards, 1957–1969:
A Memorial to Henry Ford and Edsel Ford
edited by James R. Killian, Jr.
The Atoms for Peace Awards were presented in a series of ten ceremonies to twenty-two persons from many countries who were judged to have made significant contributions toward the peaceful application of the atom. This volume records the tributes, the citations, the responses, and the addresses that were given at the ceremonies.
$15.00

Leo Szilard:
His Version of the Facts
Selected Recollections and Correspondence
edited by Spencer R. Weart and Gertrud Weiss Szilard
This volume presents Szilard's recollections complemented by 121 documents, carefully selected, annotated, and interwoven by the editors from a vast body of material.
The book reveals hitherto undisclosed facts about significant episodes in atomic research and "atomic politics" from 1933 to 1945.
$17.50

The MIT Press
Massachusetts Institute of Technology
Cambridge, Massachusetts 02142

instead of emphasizing this excellent work, the report chooses to emphasize the study's sweeping generalizations about energy policy—generalizations which are based on an incomplete and frequently misleading review of the literature and a few simple calculations which do not address issues which are most critical for this year's policy decisions.

The fundamental premise of the APS study is that no photovoltaic technology should receive major support unless it can be shown that—based on this technology—large, isolated photovoltaic systems financed by privately-owned electric utilities can compete with the busbar costs of electricity from coal-fired electric plants. While no one would argue that research directed at this objective should not receive priority attention, the near-term objective of the development and demonstration programs should be to develop a technology which can produce electricity at rates which are attractive in some limited part of the U.S. electric grid. Experience gained from such early markets would greatly accelerate the development of products built around any future photovoltaic technologies.

The APS work provides no help in finding or evaluating these near-term markets because it did not explore a number of critical variables:

- It does not examine any systems which use cogeneration.
- It does not examine small "on-site" photovoltaic systems in spite of the fact that several recent calculations performed for the Department of Energy and independent organizations have shown advantages for on-site systems.
- The study makes no attempt to examine systems financed by a home mortgage or by a municipal utility.
- The study makes no attempt to examine the correlation between the availability of photovoltaic energy and utility demands. The study asserts that photovoltaic equipment can take no credit for displacing hydrocarbon fuels used for utility peaking (a result proved by hypothesis) and provides no useful examination of the technology or the economics of energy storage.

Two specific conclusions of the study are (1) that it is unlikely that cells made from single crystals of silicon can be manufactured at a price which can reach the Administration's goal of 50-cents-per-peak-watt by 1986; and (2) that this price goal is uninteresting since systems built around 50-cents-per-peak-watt cells cannot be economically attractive. Accepting these conclusions would argue for the abandonment of a key part of the Administration's program for developing a major photovoltaic industry in the near future.

The conclusion about the economics of systems based on 50-cents-per-peak-watt cells is vulnerable because, as indicated earlier, the calculations fail to explore several critical variables. It is interesting to notice, however, that by APS's own esti-

mates, the price of electricity from 50-cents-per-peak-watt systems is about 20 percent higher than the upper range of costs computed for coal-burning plants. One may well argue that 20 percent is an acceptable price to pay as a subsidy for an environmentally benign, renewable energy resource. The conclusion about the feasibility of manufacturing 50-cents-per-peak-watt cells from single crystal silicon also will not withstand careful review.

The study group calculates that the cost of photovoltaic arrays manufactured by pulling ribbons of single crystal silicon is unlikely to be less than 73 cents per watt. This estimate was not based on any independent analysis of costs but by reference to work performed under contract for the Jet Propulsion Laboratory. The JPL group, however, has used the same references and updated reports from the same sources in an extensive analysis of cell costs, concluding that it may be possible to manufacture arrays using the ribbon process for 46 cents per peak watt.

The APS study cannot provide an adequate base for making policy on photovoltaics. Clearly an optimum strategy does not involve simply waiting for research laboratories to sort out the multiple technical opportunities as the American Physical Society implies. If photovoltaic equipment is expected to produce the ½ quad of primary energy equivalent which the American Physical Society suggests as an upper limit of the potential of photovoltaic by the year 2000 (an estimate which itself may be overly cautious), it will be necessary to begin to develop a manufacturing industry around a less than optimum technology in the very near future with the full expectation that research progress may make the techology selected obsolete. □

Henry Kelly, a physicist, is manager of the technology and world trade program of the U.S. Office of Technology Assessment.

The reading table

William Henry Bragg, 1862-1942: Man and Scientist
by G. M. Caroe
Cambridge University Press, 1978
224 pages, $16.95

This charming memoir of William Henry Bragg and his world is written by his daughter, but quotes extensively from the senior Bragg's correspondence and an autobiographical manuscript which he wrote in 1927. Although his research career was confined to the present century, in many ways Bragg's life as man and scientist is reminiscent of an earlier age. It is a fascinating fact that Bragg began active research only after he had reached his fortieth year.

There is much stimulating material here for the historian and sociologist of science: his feud with Charles Glover Barkla; his complex relationship with his son Lawrence; his lifelong interest in scientific education and the popularization of science; his concern for the social utility and responsibility of the scientist. Scholars will note in the book certain annoying eccentricities. Some of Sir William's letters are reprinted in full in an appendix. Others, equally important, are excerpted in the text. There is unfortunately no bibliography of scholarly or popular works by Bragg.

The book deserves to be read by a general audience. While it can be studied profitably by those interested in the evolution of scientific ideas and the emerging social relations of science, a full-scale biography of the senior Bragg is still needed. Ideal would be a joint biography of William Henry and William Lawrence Bragg. □

The U.S. Senate and Strategic Arms Policy, 1969-1977
by Alan Platt
Westview Press, 1978
144 pages, $13.00

This is a fairly useful if less than exhaustive or definitive analysis of Senate's role in the formulation of strategic arms policy from the ABM debate of 1969 to the consideration of SALT II in 1977. An answer is sought to the question of whether the expectation of more intense congressional involvement in the shaping of strategic arms policy signaled by the ABM debate has been borne out by events of the 1970s, especially SALT I and II and selective counterforce targeting.

While some scholars and journalists have found evidence of greatly increased legislative involvement, the author's conclusion is that Senate participation in these policies (which he claims is by and large tantamount to congressional participation) was in fact "superficial, rather than substantive; marginal, rather than central; more concerned with form than content," with the result that the executive branch dominated decision-making. Although Congress has used its appropriations power effectively in a number of policy areas, including some related to national defense, it has surprisingly only dimly perceived the budgetary trade-offs and priority setting strategies which are within its purview in the strategic arms area. Nevertheless, it is in that area of strategic policy where appropriations are directly required for implementation, namely strategic counterforce targeting, where the Senate's role was most significant.

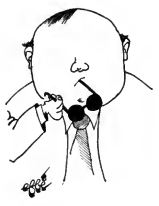
It is a weakness of the book that the Senate's role in SALT II during 1977, which may signal an increase in its policy involvement, is attached as an appendix and seems not to have affected the thrust of the argument in the body of the text. □

No Other Gods: On Science and American Social Thought
by Charles E. Rosenberg
Johns Hopkins University Press, 1978
291 pages, $4.95

This volume gathers together in an accessible format at an attractive price essays which earlier appeared in a variety of books, some now out of print, and journals, some specialized and obscure. Here can be found a generous sample of the works of one of the most important historians of science in American society. Considering the range of time during which they were written and the disparate audiences toward which they were directed, the essays cohere remarkably well in book format.

A long introductory essay explores the complex and persistent relationships of science to social thought throughout the history of the United States. In the nineteenth century, the impact of natural science and the prestige attached to its practitioners increasingly carried into the realm of human behavior: metaphors from biology and physics were used in an effort at understanding human potential and its limitations, and also the evolution of social patterns. Only at the end of the nineteenth century did the values intrinsic to modern science—especially peer approval and esteem—exceed a concern for the ability of science to further broader social values.

The experience of genetics is illustrative: progress in human genetics was delayed by society's demand that geneticists provide solutions to social problems, solutions which certain geneticists only too readily and disastrously provided. The book is filled with lessons and insights into a number of other important areas in the relationship of science to social thought which are now dimly remembered, but which may have great relevance to contemporary problems. □



Atlantis: Fact or Fiction?
by Edwin S. Ramage (Ed.)
Indiana University Press, 1978
224 pages, $10.95

This volume consists of papers presented at a panel discussion sponsored by the Indiana University Department of Classical Studies in April 1975. It brings together the results of the researches of scholars from a variety of fields, who have examined the Atlantis question objectively and dispassionately. It is to be hoped that the book will help those desiring to do further work on the subject withstand the ever-increasing tide of Atlantomania which has swamped previous scholarship and caused potential researchers to flee in terror.

The papers are examples of the use of the scientific method in the fields represented. Taken together, they illuminate numerous facets of the Atlantis myth and explore the depths of its roots in history and legend. On the whole, little evidence is found of the historical existence of Atlantis and its cataclysmic destruction.

One of the more popular modern theories equates Atlantis with the Minoan civilization, which is held to have been destroyed or gravely weakened by a volcanic eruption at Santorini (Thera) about 1450 B.C. Subsequently, the event was incorporated into Egyptian legend, from whence it reached Plato through Solon. John V. Luce finds evidence to support this theory in his explanation of the literary sources of Plato's *Timaeus-Critias*. However, the weight of evidence provided by Edwin S. Ramage (classicist), S. Casey Fredericks (mythologist), Dorothy Vitaliano (geologist) and J. Rufus Fears (historian) is clearly on the side of Atlantis as just another of Plato's myths.

This is a well-written, throughly documented and entertaining book. It will be an indispensable source for professional catastrophists and, at the same time,a joy to all laymen fascinated by the Atlantis myth. □

This month the Reading Table was prepared by Paul de Forest, professor of political science, Illinois Institute of Technology.

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From Australia

JOSEPH CAMILLERI

Nuclear controversy in Australia: the uranium campaign

Although there are two research reactors at the Australian Atomic Energy Commission research establishment near Sydney, there are no present plans in Australia for the nuclear generation of electricity on a commercial scale. A proposal to establish a nuclear power plant at Jervis Bay was seriously considered in the late 1960s, but eventually rejected largely on economic grounds. The nuclear controversy in Australia is of very recent origin and centers primarily on the proposed mining and export of uranium.

Between 1955 and 1963, Australian mines produced about 6,000 tons of uranium oxide, but it was intended exclusively for the British and American nuclear military programs. It was not until 1972 and the imminent prospect of a Labor government that several contracts were hastily approved, amounting to some 9,000 tons, most of which was to go to Japanese electricity generating utilities between 1974 and 1986. By 1975 conservative estimates suggested that Australia had 21 percent of the non-communist world's known recoverable uranium reserves at a price of less than $15 (U.S.) per pound.[1]

On assuming office in December 1972, the Labor government announced that it would honor existing contracts, but delay further contracts in order to gain direct control over the exploration, processing and marketing of Australian uranium, in the belief that only such control would eventually provide the financial return commensurate with the strategic importance of Australia's vast reserves. The government's other objective was to increase the value of uranium exports by establishing an enrichment plant with the assistance of European technology and Japanese capital.[2]

The temporary moratorium on uranium exports was essentially a tactical move in Labor's long-term resource strategy. However, powerful domestic and external pressures soon compelled the government to yield ground, and in October 1974 a preliminary agreement was announced for the development of the large Ranger deposit in the Northern Territory.

In response to mounting public concern, the Whitlam government, acting in accordance with its Environment Protection (Impact of Proposals) Act 1974, set up the Ranger Uranium Environmental Inquiry to investigate and make recommendations in relation to "all environmental aspects" of uranium mining. The Commission which conducted the Inquiry heard evidence from dozens of expert witnesses over a period of 18 months. The pro-nuclear side was represented by the large mining interests, the Atomic Energy Commission, some members of the scientific and technological community, especially those from nuclear physics and nuclear engineering, and sections of the government. Opposition to the project was spearheaded by environmental groups, churches, Aboriginal and other community organizations —all operating on shoe-string budgets.

By the time the Inquiry released its first report in October 1976—the Labor government had been dismissed from office in November 1975 and replaced by a Liberal-National Country coalition with Mr. Fraser as prime minister—a strong and broadly based movement had grown up in Australia in opposition to uranium mining. Though the first spark had been provided by conservation organizations, notably Friends of the Earth, and the relatively small Australia Party, the movement now included several of the major Christian churches, some of the state branches of the Australian Labor Party, key blue- and white-collar unions and trades and labor councils, teachers' associations, the Doctors' Reform Group, and a large number of scientists.

An important catalyst for the anti-uranium campaign had been the decision of the Australian Railways Union in April 1976 to call a one-day national strike of its members. This action was in support of the position adopted by the Australian Congress of Trade Unions (ACTU) which had imposed a ban on the mining and export of uranium pending the findings of the Ranger Inquiry. In the following month a national bicycle ride against uranium attracted over 400 cyclists, and in November-December, demonstrations in major Australian cities brought more than 7,000 people into the streets. A loose national structure under the name *Uranium Moratorium* had now been established to give a sense of national direction to the movement, although it was agreed that most of the initiatives would still come from the state campaigns centered in the main cities and variously called the Movement Against Uranium Mining (Melbourne, Sydney, Canberra), the Campaign Against Nuclear Energy (Western Australia, Southern Australia), and the Campaign Against Nuclear Power (Queensland).

While the results of opinion polls varied considerably, it was now clear that at least one-third of the public was opposed to uranium mining. A reputable survey published in July 1976 showed that 57 percent of respondents believed that Australians "should be more concerned about the possible harmful effects of nuclear development on future gen-



Hiroshima Day rally in Melbourne, August 6, 1978.

erations than about selling uranium."[3] Highly confidential documents leaked to Friends of the Earth from the files of a uranium producer and its subsidiary confirmed the establishment in the early 1970s of a uranium producers' cartel, and also revealed the deep disquiet shared by the mining companies in the face of mounting opposition and increasing media exposure of the dangers of the nuclear industry.[4]

With the publication the First Ranger Report which dealt with the larger environmental and global implications of uranium mining, public controversy increased and membership in the key organizations in the movement expanded accordingly. The Report emphasized the many dangers associated with nuclear power, in particular the unresolved problem of waste disposal, the risk of nuclear proliferation and the possibility of nuclear theft, sabotage and blackmail.

In one of its key recommendations, the Ranger Commission stated:

"Policy respecting Australian uranium exports, for the time being at least, should be based on a full recognition of the hazards, dangers and problems associated with the production of nuclear energy, and should therefore seek to limit or restrict expansion of that production."[5]

Having recognized that many of the questions involved are ultimately "social and ethical ones," the commission concluded that "the final decisions should rest with the ordinary man," and recommended ample time for public consideration of its report and for debate on it. Obviously, the responsibility for such a decision was too large to be entrusted to the nuclear industry, to the bureaucracy, to the government, or to "any group of scientists or experts, however distinguished."[6]

And yet it took only 14 days from the release of the Commission's First Report for the government to authorize the export of uranium to fulfill existing contracts. It was obvious, however, even then that this partial go-ahead was primarily designed to embarrass the Labor Party, which had committed itself while in office to the honoring of existing contracts, and to establish the uranium industry before the Australian public had had the opportunity to consider the issue.

To maintain the momentum of the pro-uranium campaign, the government in concert with the mining industry launched a public relations effort which suggested that the Ranger Report had given a green light to uranium mining. However, an intensive educational campaign by the anti-uranium movement succeeded in raising community awareness. For their part, the commissioners let it be known that they were deeply disturbed by the misleading interpretation of their report. Within days, the media changed their tune and began to present a more cautious and balanced assessment of the Inquiry's recommendations.

Gaining the support of the Australian labor movement was now a primary objective of the anti-uranium campaign. Accordingly, close links were established with some of the most sympathetic unions, and intensive lobbying was carried out at various levels of the Labor Party organization in the hope of securing a firmer policy. In the meantime, the national Uranium Moratorium organization had adopted a position calling for a five-year moratorium on the mining and export of uranium to ensure the widest public and parliamentary discussion.

A widespread and intensive community education campaign was launched involving a series of public meetings and mass rallies in capital and provincial cities attended by some 80,000 people, another national bicycle ride, and a national signature campaign calling for a five-year moratorium on uranium mining and the development of an energy policy based on renewable energy sources and environmentally acceptable technologies. Within three months some 250,000 people had endorsed the statement, but the great success of the project was not so much the number of signatures collected as the widening of the debate and the growing participation of an ever larger section of the community.

By the time the Second Ranger Report was issued in May 1977, the anti-uranium campaign had established itself as a significant political force. As in its First Report, the Inquiry refused to give any simple go-ahead to the mining industry. It acknowledged that the Aboriginal population which would be directly affected by the mining was not in favor of the Ranger proposal. Although the Inquiry did not consider Aboriginal opposition a sufficient reason for recommending against mining, it stressed that considerable damage to Aboriginal society and culture could result from the mining operation. The Second Report, in fact, rejected the specific mining proposal submitted by the Ranger partners, and outlined a number of very stringent conditions which would have to be followed if any mining were to take place. More importantly, the Inquiry insisted that, should a decision be made in favor of mining, uranium development would need to be pursued se-



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quentially, so as to minimize the adverse impact on Aboriginal land.[7]

When formally announcing his government's uranium policy on August 25, 1977, the Australian prime minister referred to "the exhaustive consideration of the issues" and "the high sense of moral responsibility" which led to the decision. Far from accepting the findings and recommendations of the Ranger Inquiry, the Fraser government ignored or rejected the main thrust of the Inquiry's two reports.

As for the problem of waste disposal, Mr. Fraser said:

"The technology for the handling, solidification and safe storage of the high-level radioactive liquids exists. It is now being developed to a commercial scale."[8]

The Ranger Commission had concluded, however, in its First Report:

"There is at present no generally accepted means by which high level waste can be permanently isolated from the environment and remain safe for any long periods."[9]

And yet it was widely believed, contrary to Mr. Fraser's reassurances, that in return for uranium sales Australia might well have to become a dumping ground for the highly toxic wastes of consumer countries, notably densely populated earthquake-prone Japan.

The new strategy for the disposal of high-level radioactive wastes announced in July 1978 by Professor Ringwood, Director of the Research School of Earth Sciences at the Australian National University, criticized the vitrification process which both industry and government had accepted as the solution to the problem.[10] As for Professor Ringwood's own proposals, they had yet to be submitted to critical scientific scrutiny, and several doubtful areas still required careful study and prolonged research.

Regarding the dangers of nuclear proliferation, Mr. Fraser argued that uranium exports would be conditional on "effective nuclear safeguards and the avoidance of the misuse of nuclear materials." But these safeguards involved little more than assurances of good faith by the parties to the NPT. In any case, several countries had so far refused to ratify the treaty. Although transfers to such countries are covered by the safeguards laid down by the International Atomic Energy Agency (IAEA), it is in practice impossible even with bilateral safeguards arrangements of the type envisaged by Mr. Fraser's government, to guarantee that a consignment of uranium will not be diverted to military purposes.

Taken together, the limitations of the existing international safeguards system were so serious that, in the view of the Ranger Commission, they were likely to provide "only an illusion of protection." Professor Charles Kerr, one of the three commisioners, described the Fraser government's international safeguards as "virtually useless," and "full of loopholes."[11]

The commission felt that Australia could make a genuine contribution to the energy requirements of other countries by concentrating on the production of liquid and gaseous fuels and the supply of coal as a replacement for oil. In the longer term the development of solar technology provided the most promising alternative, especially for low and intermediate heat applications.

The government was clearly having difficulty creating a national consensus in favor of its policies and the advertising campaign conducted by the mining industry through the Uranium Producers Forum had not succeeded. In October 1977, the *Age* opinion poll revealed that opposition to uranium mining had increased from 34 percent in June to 42 percent in late September.[12] An equally important development was the reversal of policy by the Labor Party at its Federal Conference in July 1977. The new policy called for an indefinite moratorium on the mining and export of uranium, reserved the right of a future Labor government to terminate contracts entered into by the present government, and rejected the opening of any new mines in order to fulfill existing contracts.[13]

Although the Labor Party had taken a major step forward in its opposition to nuclear power, its case still rested largely on the dangers of waste disposal and nuclear proliferation. Most Labor leaders were happy to sidestep the whole range of other troublesome questions, namely Aboriginal land rights, civil liberties, the economics of the nuclear industry, the politics of nuclear power, and more particularly the centralization of control associated with the nuclear states.

In the industrial area, the Metal Workers, the Seamen, the Waterside Workers, the Miscellaneous Workers and several other key unions were also strengthening their opposition to uranium mining. Following demonstrations in several cities protesting shipments of uranium, the Waterside Workers in Melbourne decided to place a ban on all future ships carrying uranium cargo. That decision, taken in defiance of the current policy of the union's federal organization, was a sign not only of the intensity of local feeling but also of the close bond which had developed in many areas between trade unions and the environmental movement.

The Australian Congress of Trade Unions (ACTU) responded to the government's announcement in August 1977 by calling for a referendum to determine the wishes of the Australian people. The government, which was given two months to reply affirmatively, rejected the proposal. It was now readily apparent that the ACTU leadership were anxious to find a face-saving formula which would avoid a direct confrontation with the government. To this end, the ACTU proposed a plebiscite of all its affiliates involved in the industry, but the tactic proved abortive as several unions refused to participate.

At a special conference of affiliated unions in February 1978 it was eventually decided that labor would not be made available for the opening or operation of new mines until the government had satisfied the ACTU that the legitimate demands of the Aboriginal people had been met, and that adequate measures existed to deal with the hazards of waste disposal and nuclear proliferation. No doubt the ACTU was hoping that suitable reassurances on these matters would be forthcoming from the government. But even if this device were used to give the green light to uranium mining, there was little prospect that strategic unions would modify their opposition. What was less clear was the form such opposition might take.

The Fraser government's massive election victory in December 1977—uranium scarcely featured in the election campaign—and the manoeuvring of the trade union hierarchy had undoubtedly slowed down the momentum of the anti-uranium campaign. The pro-uranium interests had by now adopted a strategy of silence.[14] They were deliberately avoiding public discussion of the issues. The Uranium Producers' advertisements had stoped. Yet a poll published in May 1978 showed opposition to uranium mining still standing at about 40 percent. In Melbourne (population 2.3 million), 47 percent were opposed to government policy as against 46 percent who supported it.[15]

But the paucity of media coverage in no way reflected the often furious activity behind the scenes. Mining interests were desperately searching for contracts, a task now made exceedingly difficult by the very substantial fall in the world demand for uranium. Numerous visits by Australian officials and company executives to the world's capitals had so far yielded few commercial prizes. After being in office for nearly three years, the government was still not able to claim a single contract.

Within Australia much of the thrust of the pro-uranium lobby was directed against the Northern Land Council (NLC), a statutory body representing Aboriginal communities in the northern half of the Northern Territory and required to present Aboriginal land claims and negotiate with companies wishing to use Aboriginal land. The government would not allow the NLC to veto uranium mining; it was required by law to negotiate and to reach agreement. Moreover, the government reserved the power to overrule the NLC, should the negotiations break down, and appoint an arbitrator whose decision would be binding on the NLC.

Having been forced to accept uranium development as inevitable, the Northern Land Council proposed, in line with the recommendations of the Ranger Inquiry, a strictly limited and sequential approach to mining, in the hope of minimizing the degree of environmental disturbance. However, the Aboriginal proposal that uranium development begin with the small rich ore body at Nabarlek rather than the much larger Ranger project was rejected by the government.

Having entered into negotiations under duress, the Northern Land Council set out its position in a draft agreement, but its basic financial environmental demands were again rejected by government officials negotiating on behalf of the Ranger companies. The leadership of the Northern Land Council finally succumbed to the pressures of the government, and ratified an agreement which provided Aborigines with royalties of only 4.25 percent. More importantly, the agreement fell far short of the desired environmental safeguard provisions, particularly in relation to the reclaiming of mining pits and the release of contaminated water.[16]

It became apparent that the agreement had been imposed on the Northern Land Council without the full support of its members and without appropriate consultation with the various Aboriginal communities. Mounting Aboriginal protest against the signing of the agreement and court actions challenging its legality effectively delayed its ratification.



Artist's impression of the Ranger mine and mill site in Australia's Northern Territory.

The government, however, eventually secured the necessary formal endorsement from the Northern Land Council and the traditional land owners, although it was clear that the former group had not been given the opportunity to consider the terms of the agreement, while the latter group had repeatedly voiced its opposition to the government's mining plans.

But black Australians were not the only ones adversely affected by the politics of uranium. Legislation enacted in May 1978 empowered the government to declare the Ranger project as coming under the 1953 Atomic Energy Act, a piece of legislation originally framed for defense purposes. Under the Act a person may be imprisoned for 20 years for conveying restricted information, or acquiring such information, or removing information, with the intent to prejudice defense. What constitutes such intent is left deliberately vague. A person may be convicted not by demonstrating his guilt but by showing that he *appeared* to act with the intent.[17]

An even greater threat to civil liberties arises from the Approved

Defence Projects Protection Act, under which any work or undertaking by the Atomic Energy Commission may be termed an "approved defence project." As a consequence of this Act, any person who boycotts or threatens to boycott, or in any way obstructs, or by speech or writing advocates the obstruction of an approved defense project is guilty of an offense carrying a maximum penalty of $10,000 or 12 months imprisonment or both. In other words, any worker refusing to handle uranium or any activist opposing the mining of uranium by participating in a demonstration or even a seminar could be liable for prosecution under the Act.

In addition, the uranium legislation introduced by the Fraser government invests the Atomic Energy Commission with the duties of both regulating (that is, applying safeguards) and promoting commercial uranium development, thereby creating a sharp conflict of interests. The exclusion of public scrutiny over the environmental, health and safety aspects of uranium mining is reinforced by secrecy provisions in the Environment Protection (Nuclear Codes) Bill which also enables the Governor-General to give a Minister sweeping powers to deal with so-called emergency or unforeseen situations.

In July 1978 a safeguards agreement with Finland was announced.[18] Apart from containing the very safeguard arrangements considered inadequate by the Ranger Inquiry, the agreement made a major retreat in the one area where Mr. Fraser appeared anxious to make a strong stand.

Until now the official position had been that no country buying Australia's uranium would be permitted to reprocess without Australia's prior consent. Such a condition was designed to give at least partial support to President Carter's policy of indefinitely deferring the commercial reprocessing and recycling of plutonium.

However, while the agreement with Finland did require prior consent, provision was made for such consent to be given should the "energy requirements and the needs of the recipient party for proper management of spent nuclear fuel and for nuclear waste disposal" demand it. Moreover, the agreement, which was provisional and liable to be changed pending unspecified international agreements, entitled the seller to receive the conclusions but not the full report on IAEA inspections, as was originally foreshadowed.

The government yielded still further ground in its second safeguards agreement which it concluded in early August with the Philippines. Under the agreement, NPT/IAEA safeguards are not mandatory, and the minimum requirements for physical protection are less stringent than those required by the International Atomic Energy Agency, which are themselves far from satisfactory. Indeed, the whole tenor of the agreement shows greater concern with the promotion of nuclear technology than with the safeguarding of its use.[19]

The government has had to backtrack on its safeguards policy—inadequate as it was—because that was the only way it could secure at least a few contracts at a time when the worldwide demand for uranium was falling sharply.[20] That the first two safeguards agreements should have been concluded with Finland and the Philippines, countries with rather limited nuclear power potential, was in itself a comment on the state of the market.

While gradually laying the foundations for a fully-fledged uranium industry in Australia, mining interests and their political representatives are finding their path strewn with obstacles. The economic difficulties of the nuclear industry, the inextricable link between nuclear power and nuclear weapons, the rising tide of opposition to the nuclear option both at home and overseas, and the growing attraction of alternative energy technologies are combining to challenge the government's uranium policy. The anti-uranium campaign in Australia is yet far from victory, but it has achieved significant success.□

1. *The Australian Mines Handbook 1976–77*, 62.

2. For a much fuller account of the Labor government's uranium policy, see J. Camilleri, "Uranium Exports: Commercial Incentives Versus Nuclear Dangers," *Australian Outlook*, 20, 1 (April 1976). See also Gary Smith, "Fueling Up for Disaster," *Arena*, No. 42, 1976.

3. *The Age* (Melbourne), July 29, 1976.

4. See Denis Hayes, Jim Falk, Neil Barrett, *Red Light for Yellow Cake*, Melbourne, Friends of the Earth Australia, 1977, 80–81.

5. *Ranger Uranium Environmental Inquiry First Report* (Canberra: Australian Government Publishing Service, 1976) 185.

6. *Ranger Uranium Environmental Inquiry First Report*, p.6.

7. *Ranger Uranium Environmental Inquiry Second Report* (Canberra: Australian Government Publishing Service) 1977, esp. chapters 6, 13, 20.

8. Ministerial Statement, August 25, 1977, in *Uranium—Australia's Decision*, Canberra: Australian Government Publishing Service.

9. *Ranger Uranium Environmental Inquiry First Report*, p. 110.

10. A. E. Ringwood, *Safe Disposal of High Level Nuclear Reactor Wastes: A New Strategy*, Canberra: Australian National University Press, 1978.

11. *The Age* (Melbourne), August 31, 1977.

12. *The Age* (Melbourne), October 17, 1977.

13. For a more detailed examination of the response of the Labor movement see J. Camilleri, "The Politics of Uranium Mining", in *Issues 1977*, Department of Continuing Education, University of Adelaide.

14. See Speech by Tom Uren, M. P. to Activists' Conference, Movement Against Uranium Mining, Sydney, June 24, 1978.

15. *The Age* (Melbourne), May 1, 1978.

16. *The National Times*, week ending September 9, 1978.

17. See Michael Flood, Robin Grove-White and Keith D. Suter, *Uranium, The Law and You* (Sydney: Friends of the Earth, 1977) 15–33.

18. Australia/Finland Nuclear Safeguards Agreement, *Minister for Foreign Affairs News Release*, No. M84, July 20, 1978.

19. Australia Philippines Nuclear Cooperation and Safeguards Agreement, *Minister for Foreign Affairs News Release*, No. M89, August 8, 1978.

20. Michael Richardson, "Uranium: Demand May be Overestimated," *The Australian Financial Review* (November 18, 1977), 12–13.

From Mexico

MIGUEL S. WIONCZEK

Science and technology *for* development

As the time approaches for convening the 1979 U.N. Conference on Science and Technology for Development (UNCSTD) in Vienna next August, the predominant mood is one of malaise. Most of the criticisms—and the source of this malaise—involve the institutional mechanisms which were established for the Conference.

Its secretariat is widely criticized for "not providing more of the analytical tools required for discussing how to handle science and technology for development."[1] The governments of the less developed countries (LDCs) come under fire for not showing much interest in Conference preparations. In most cases, they are leaving the work on the national papers, which are expected to represent the core of that global meeting, "to institutions and individuals of little weight in the political, economic and cultural life of the country."[2] Nor do the advanced countries appear to be very interested.

Although I subscribe to most of these criticisms, I do not propose to add more fuel to that particular fire. Instead I will attempt to address some major underlying issues responsible for the very uncertain prospects for the meeting.

These issues may be divided into three categories:

- the present state of the world economy, which largely explains the industrial countries' lack of interest;
- the socio-political background of the LDC attitudes toward science and technology, which explains the excessive bureaucratization of their preparations; and,
- the *modus operandi* of the United Nations system by which the UNCSTD Secretariat functions.

A brief analysis of these three issues strongly suggests that the widely expected failure of the Conference has been assured beforehand by the forces which cannot be controlled by the UNCSTD institutional mechanisms themselves.

While many scientists and some technologists may not see any connection between the world economy, science and technology and the prospects for the Conference a direct connection exists. Indeed, the problem starts here.

Growing evidence suggests that the advanced countries have recently—since 1970—entered a stage of protracted economic stagnation accompanied by increased uncertainty about the rate of future science and technology (S&T) advancement.

The present decline in the growth rate of the advanced countries has already seriously affected growth prospects in most of the less developed countries (excluding a few fortunate oil producers). Even these low LDC growth rates are sustained only by increasing financial dependence upon the advanced countries and the few oil producers, a dependence reflected in the continuous expansion of the LDC external debt at rates clearly unsustainable in the longer run. Briefly, in the midst of a major international economic crisis, the dependence of the LDCs on the overall growth of the advanced economies is greater than ever.

Some radical social scientists suggest that the LDCs should "delink" themselves from the advanced sector of the world economy and become self-reliant, but no one as yet has been able to offer a reasonably coherent political and economic model for such "delinking" and "self-reliance" in trade, finance and technology. The fact that socialist countries—including China—have been expanding their relations with the world economy because of their need for more trade, more finance and more technology, suggests that the design and the implementation of such a model might be extremely difficult.

Certain disquieting developments which feed the uncertainty about future S&T progress, particularly with regard to industrial innovation, should be considered in the framework not only of general economic stagnation but also of power politics. The attempts by many major western countries to close the technological gap with the United States provoke growing U.S. fears of losing its lead in technology.[3] Both developments may have most serious negative consequences, not only for technological interchange among the western advanced countries but also for the less developed world.

I wish someone could convince me that the situation is not so serious. During my recent stay in Europe I discussed at length, with knowledgeable people of many nationalities, the western S&T problems and policy issues. They all seem to agree, first, that the present unprecedented level of socio-economic welfare enjoyed by the advanced industrial societies has been largely due to the concentration and the exceptional rate of western S&T progress over the past 100 years; and second, that, as demonstrated by the postwar emergence of West Germany and Japan, a causal relationship can be established between S&T advancement and international changes in the distribution of political power. Nevertheless, discussion of the present and the future is gloomy.

General consensus exists about the growing economic and S&T competition among the United States, West Germany and Japan. Most of



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my interviewees link it with the uncertain future of the world economy and with each country's internal necessity to defend its share in that economy which is presently expanding much more slowly than in the past quarter-century. Many envision the emergence of technological protection measures a corollary to the increasing wave of trade protectionism. Some also relate the trend toward technological protectionism to signs of the slowdown in S&T advance which, in turn, seems related to the overall economic stagnation.[4]

As proof accumulates that neither economic growth nor S&T advancement is automatic, preparations for the biggest global encounter on science and technology for development, the Vienna meeting, coincide at least in the industrial west with deep and increasing uncertainties about the future of growth, of science and technology—and of development as well. Worse still, neither economists nor S&T practitioners seem to possess analytical tools that explain what has been happening lately both in the world economy and in the global S&T advance.

These uncertainties for the less developed countries cannot be resolved by questioning the importance of growth and the relevance of S&T advance, as they may in more developed societies. At their present income and welfare levels the latter may forego more economic growth and live quite comfortably with their slowly expanding stock of S&T, provided they use it in socially more meaningful ways.

This static recipe does not offer, unfortunately, a satisfactory solution for the LDC problems. First, the nature of international economic relations is such that the persistent slowdown in the growth rate of the advanced countries will ruin whatever limited prospects the LDCs may have to alleviate their present overall social and economic misery. Second, the nature of S&T relations among the advanced countries suggests that because of economic stagnation and the dynamics of power politics, access to science and technology in the less developed nations may suffer further limitations.

Thus, western Europe's lack of interest in the UNCSTD and the United States' apparent inability to commit itself to any concrete program of assistance may be explained more simply than was supposed.

If the major advanced countries are so concerned with their relative technological positions; if they believe that technology is the key to economic and hence to political power; and if, finally, world economic prospects are highly uncertain, then at least in the short run, these countries would have no reason to promote the rest of the world's access to proprietary technology, or to assist the less advanced states to build up their S&T capability.

Indeed, given the static international economic situation, one might ask why the industrial countries would foster competition when too much competition already exists. The beggar-your-neighbor attitude would strongly favor not only trade protection but "technological defense" as well. All this does not bode well for either the disadvantaged nations as such, or for the success of the Conference.

To explain the LDCs' lack of genuine political interest in science and technology on the eve of the UNCSTD, we must recall how their governments got involved in these matters. The explicit interest of these countries, especially those more developed in science and technology, dates only from the early 1960s. It followed the belated discovery by economists from the advanced countries that technology is an endogenous factor in economic growth, at least as important as capital, labor and physical resources.

The "discovery" of science and technology by the LDCs can also be related to:

- advancing industrialization;
- their economists' penchant for macroplanning exercises;
- the confidence of technocrats that science and technology can be fostered without the interest of the private—either domestic or foreign—sector; and finally,
- the influence of some parts of the U.N. system such as the Advisory Committee on Applications of Science and Technology (ACAST) and the U.N. Office for Science and Technology, as well as international agencies like UNESCO and the U.N. Conference on Trade and Development (and the OAS in the case of Latin America).

Most probably each of these factors contributed to the creation, some ten years ago, of government agencies in Latin America and major Asian LDCs which were known as National Science and Technology Councils whose purpose was to design S&T policies.[5] In the late 1960s some of these countries, bent upon rapid industrialization, created additional policy instruments to regulate technology imports and modernize national industrial property legislation. All these initiatives were based on the assumption that the coalition of state, national S&T communities and the local, private industrial technology users would support policies which expanded domestic capability and related it to national development needs.

The past decade has demonstrated that with very few exceptions (Brazil and India perhaps) these expectations were too optimistic. Proponents of autonomous scientific and technological development found it extremely difficult to mobilize state, domestic entrepreneurs and scientific communities for their cause. Governments in these countries proved to be relatively unknowledgeable about S&T problems; domestic entrepreneurs found nothing wrong in a profitable coexistence with technological dependence; and weak local scientific communities responded with suspicion to what

looked like bureaucratic interference with their liberties.

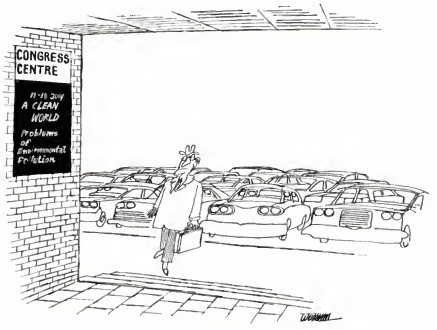
Consequently, National Science and Technology Councils were bogged down in marginal bureaucratic activities. Without high-level political support attempts planning for science and technology withered away and the expected rapprochement between the scientific community and the users of S&T did not occur. Both private enterprise and the public sector continued importing foreign technology indiscriminately and on a large scale, and the infrastructure for S&T remained weak and disjointed.

The impact of the international economic crisis on the disadvantaged nations, which augmented their dependence upon foreign private interests and resources, made progress even more difficult. In the wake of mounting social and economic difficulties, the states started losing interest in science and technology while foreign and domestic private sectors, under the banner of free economy, launched a subtle but vigorous campaign against public intervention in that domain.

These developments led to the progressive dismantling of most of the S&T policy instruments in Argentina, Mexico and Peru over the past few years. They also explain why the majority of those citizens in the less developed nations with distinguished careers in the field of S&T policy have lately abandoned their own countries for international agencies.

Further evidence supporting these assertions can be found today at an international meeting on science and technology, where most LDC delegates side with the pre-1960 school of uninitiated diplomats and bureaucrats. This sorry state of affairs has been visible also at the first two UNCSTD preparatory conferences, held in January 1977 in New York and in February 1978 in Geneva. At both, the preponderance of third secretaries from the permanent U.N. missions was far from accidental, indicating the present political attitudes to science and technology in most disadvantaged nations.

Facing all sorts of short-run crises and difficulties, the top policymakers of these countries found the meetings expendable. That foreign and domestic private interests supported their position is a matter of record.



Under these adverse conditions no miracles could be expected from the UNCSTD secretariat even if it were manned by the best available experts. Moreover, the U.N. institutional mechanisms established for the August conference have been handicapped from the beginning by the *modus operandi* of the U.N. system which, like a medieval monarchy, has few characteristics of a rational operation.

The Conference—like all other global conferences—was established on the margin of the U.N. system. While institutional expediency defined the form and the mandate, intra-U.N. political considerations dictated the choice of its secretary general, who started his reign with unequivocal gestures aimed at ascertaining his own feudal sovereignty. These gestures hardly endeared him to the competing U.N. lords, who reciprocated this "unilateral declaration of independence" with a hands-off position vis-à-vis preparations.

In the diplomatic language of the U.N. system, all these events can be described as "absence of harmonized United Nations policy on science and technology." The degree of this absence is evident in a recent report of the ad hoc Working Group on Policy for Science and Technology within the U.N. system.[6]

According to this report:

- "the United Nations system at present is composed of a wide spectrum of activities in science and technology under widely different systems of planning and implementation and with insufficient coordination among the parts, . . .
- there is also a need to ensure that greater harmonization, compatibility and complementarity be achieved between policies in the field of science and technology at the national level and those at the level of the United Nations system at large, . . .

• in the absence of clear, consensual definition regarding what constitutes a 'science and technology' category, no detailed quantitative assessment can now be made of the utilization of the currently available resources for science and technology in the United Nations system."[7]

This *sotto voce* description of the actual management of science and technology issues within the U.N. system explains the intellectually unsatisfactory level of most of the documentation elaborated for the forthcoming conference, the disappointing results of the regional preparation meetings, and the confusion surrounding the issue of "science and technology and the future"—point four of the Conference agenda.[8]

It could hardly be otherwise. Many authors of these documents and reports have had very little exposure to actual science and technology *for* development problems. Except for members of the Advisory Committee on Applications of Science and Technology, individual contributions to scientific and technological advancement are largely unknown. Furthermore, many bureaucratic interests are in conflict. The lessons of direct experience with science and technology, whether in research or policymaking, are thus replaced as the source of inspiration by earlier U.N. documents and resolutions, "sacred texts" which by saying little can satisfy everybody.

Considering the absence of "harmonized United Nations policy on science and technology," the obvious attitudes toward cooperation in the advanced countries, and those toward science and technology in the LDCs, only inveterate optimists and dreamers expect anything substantive and relevant to emerge from the deliberations in Vienna next summer.

Does this mean that $15 million (the reported budget of the UNCSTD Secretariat) and additional large sums that will be spent by the official participants in the 1979 Vienna pilgrimage represent pure waste? Not necessarily.

While the documentation and the reports from the Vienna debates will probably prove inconsequential, the preparations for that Conference are prompting many groups of concerned citizens all over the world—scholars and non-scholars alike—to answer the questions of science and technology policy in the context both of development and underdevelopment. These independent initiatives have already expanded our scant knowledge about these extremely important global issues. Such initiatives deserve to be encouraged both before and particularly *after* the fact, if only because in the world of power politics and international and national bureaucratic games, free inquiry about the forces that are shaping our future is very badly needed.



1. Jon Sigurdson, Welcoming remarks to the Lund seminar on "Technology, Science and Development in the Changing International System" (May 31—June 2, 1978), quoted in *Lund Letter*, No. 6, July 1978.

2. "National Papers—into the 'Final Stretch'," *Lund Letter*, No. 5, May 1978.

3. See as evidence the following excerpt from an article datelined Washington, D.C., International Herald Tribune, Paris, April 18, 1978:

"For decades, every new technology or its product seemed to have Made-in-U.S.A. stamped on it, from instant copying and instant photography to advanced computers, nuclear reactors, oral contraceptives, synthetic fibers and jet airliners. . . . Things have changed. There is concern in the White House and Congress, in industry and universities, that the United States is losing its technological lead."

As reported by the same newspaper on November 2, President Carter's concern over a drop in technological innovation in the United States led to a cabinet level review and to a memorandum asking a presidential aide to defend in the Congress all research and development programs contained in the budget for fiscal 1980.

4. The slowdown in s&T advance should be understood not as the decline in the rate of scientific discoveries but as the slowdown in the application of s&T for the production of goods and services and for the increase in welfare.

5. Eduardo Pablo Amadeo, "National Science and Technology Councils in Latin America—Achievements and Failures of the First 10 Years," paper presented to a Seminar on s&T Policy Issues in Latin America, Florida International University, Miami, April 1978.

6. ACAST, *Report of the Ad Hoc Working Group on Policy for Science and Technology within the United Nations System*, E/AC.52/XXIV/CHP.2, June 1978.

7. ACAST, pp. 10–11.

8. See, for example, UNCSTD, *Recommendations of Expert Group on Agenda Item 4 of Conference Agenda*, EMI/CRP.2/Rev. 2, November 1977.

From Jamaica

ARNOLDO K. VENTURA

Third World science and technological institutions

During the first U.N. Development Decade of the 1960s, the heightened awareness in developing countries of science and technology's (S & T) importance in socioeconomic growth resulted in the creation of a series of science councils and research and development (R & D) institutions modeled after similar institutions in industrialized countries. In most instances, these bodies were visualized and erected in the drive for the development of local S&T competence without the necessary plans for their proper use. Even in those cases where plans were enunciated they were not bolstered by necessary political patronage or social realization of the indispensibility of science and technology to socioeconomic growth. In some cases their creation was mainly to enhance national prestige by mimicking the research fads of former colonial masters. Many of the science councils were given defined mandates to plan, foster and coordinate scientific and technological activities, but many were unable, and did not attempt, to channel science and technology to satisfy social demands; others became incestuous and lost the respect of their colleagues. Most R & D units were afforded gala openings and staffed by a small nucleus of local and foreign scientific luminaries, but were provided little else. Those institutions which had dual responsibilities for planning as well as application of science vacillated between these two objectives and accomplished little.

Although many R & D workers assigned to these bodies were competent, efficient, and charged with good intentions, they were left to formulate projects and programs under the guidance of the broad generalities of their original mandates without any national plan or policy. Many pursued projects from their student days abroad, while others proceeded with programs and projects which they found most comfortable, or personally profitable. Without any clear national science policy or plan, these institutions, at best, occasionally produced interesting research results, but few technological solutions or innovations to meet the production demands of their societies.

As the vast majority of these institutions were state-financed, and as more rigid national budgeting became necessary, relevance to their communities was questioned, resulting in drastically reduced budgets, and loss of professional respect. This predicament arose because the rudiments of local scientific evolution were supplanted by colonial enforced scientific principles which precipitated almost total S & T dependency. The indifference of the scientific, social and political directorates to the potential of these S & T institutions to foster economic advancement was so pervasive that they were unable to conduct reasonably good basic research work, and had little or no impact on industry.

The local productive systems were becoming progressively integrated into those of the developed states, so that most of their technological needs were satisfied at escalating costs. This not only siphoned off capital which could have gone to the local R & D institutions, but also established consumer patterns which had little need for indigenous technologies. This pattern existed whether the commanding heights of the economies were state or privately controlled. This vicious cycle had so advanced that commendable developments languished in the archives of these institutions, unrecognized and uncommercialized.



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While the scientists and technologists were overcome with frustrations which eventually impaired their confidence, the users of technology also lost confidence, hesitated to select methods for their processes, and were reluctant to solicit local assistance. The local R & D institutions then became totally divorced from the productive efforts and often were not even called upon to undertake simple analyses, participate in quality control or the most prosaic of support services.

These units were prevented from implementing their discoveries and participating in the commercial use of their technologies; often, no organization had specific responsibility for implementation.

This profound weakness in the system seems best approached by providing incentives and financial assistance to the productive sector to encourage the use of local raw materials and technologies. This might have to be coupled with sanctions against the use of foreign methods and personnel.

Science councils or policy planning units were of little help to their R & D counterparts because, although they had become attached to Ministries of Finance, Planning or Development, they were not fully integrated into the national decision-making machinery, except occasionally when asked to comment on documents or decisions at the end of the planning process. While those which were cuddled under Ministries of Science and Technology often became embroiled in squabbles of alleged interference in the S & T affairs of other ministries and were likewise of minimal assistance. To make matters worse, science councils were often loaded with

political cronies, school buddies and family friends. Excellence was replaced with mediocrity, innovation with subversion, and talent with rivalry.

In this manner, these councils also became divorced from the educational system, and technological endeavours inevitably were regarded by cloistered academics as political suicide. Meaningful S & T developments which may have surfaced during this time often remained unknown or non-commercialized and the brain drain at all levels became traumatic. The councils and research institutes were then forced to hire uncreative personnel who were unable to understand their responsibilities.

The greatest obstacles to the effectiveness of science councils or R & D institutions was often the governing bureaucracy, mainly because those in critical national management positions did not understand the scientific process, the importance of science in technology, or the centrality of technology to production.

Scientific leaders must gain the confidence of these decision-makers by demonstrating the alternative solutions that appropriate technologies can bring to pressing social problems. Because many in middle level bureaucracy envision technology as a threat to their powers, technologists must aspire to become an integral and indispensable part of the top decision-making hierarchy. Comprehensive policies which clearly outline the functions of the S & T councils and institutions must be promulgated. Adequate and consistent support should be afforded to allow for short term use of existing appropriate technologies to achieve clearly defined urgent goals, and the longer term generation of permanent indigenous S & T capacity. Vibrant and reciprocating linkages must be established between R & D institutions and the educative, productive and political systems. These linkages must be forged initially by the workers in S & T institutions by maintaining adequate informational and personnel exchange contacts. Imports which satisfy the elite's luxury tastes should gradually be replaced by products and services which meet the biological, social, and cultural demands of the majority.

The ineffectiveness of these councils must be carefully analyzed as must the S & T potential available, and the priority areas for action. Flexibility to hire and retain high caliber staff must be provided while scientific activities must be freed from the dead weight of civil service bureaucracy. Decentralization of S & T activities should be encouraged as far as possible without encouraging irresponsibility and isolationism. Creative spirits must be allowed to open dialogue on all issues. The S & T system must not be begrudged funds to maintain interaction at the local, national and international levels. Recognition and recompense should be afforded institutions and workers of excellence, especially those that provide innovative solutions to pressing social problems. Proper national monitoring systems to assess the impact of S & T institutions must be created so that mistakes can readily be corrected and remembered. Science and technology workers must become sensitive to social needs and aspirations and retain contact with the political directorate and even become a functional part of the political process.

The countries of the Third World should note the failure of the systems of the developed countries to meet any of their social demands, and further realize that countries in economic and social crises need to support and channel innovative talent more urgently than those less beleaguered. Science councils and the R & D institutions of each underdeveloped country must therefore be fully supported so that they can become cornerstones of the peculiar infrastructure which will generate technologies, management and selective skills demanded by their own unique circumstances.□

Community energy systems

Charles Engelke, in his interesting article in the November *Bulletin*, proposes community-scale interseasonal thermal energy storage to be used for heating, cooling and electric power. This takes advantage of the economy of insulating large volumes and of central rather than individual-household management. He emphasizes the importance of combining different sources, particularly wind power and simple solar panels, as a unified system for multiple use. Some of the details may be found in reports of studies under the federal energy program but seem to need integration.

As regards wind power, Engelke overestimates both the cost of windmills and the amount of wind power that can be efficiently harnessed in an array of a given area. He accepts the Department of Energy's perhaps self-fulfilling pronouncement, in the National Energy Plan, that wind energy will play a very minor role, having a current cost disadvantage, relative to fossil fuels, of "a factor of nearly ten." On the contrary, projections from various non-governmental experiences in building large windmills show that large-scale wind power should have a considerable cost advantage relative to future fossil-fule and nuclear costs, as I have outlined in a recent article[1] and detailed in a recent book.[2] This means that, so far as wind power is concerned, Engelke's proposal for reducing costs should reduce them, not just from very non-competitive to about competitive, but from quite competitive to very competitive. In this sense his proposal, if it includes enough wind power and is otherwise economically viable, may go farther than he claims.

The wind-power part of the specific system he describes needs to be revised in keeping with modern wind-power experience but this does

not fault his general concept. He proposes an array of windmills 50 feet in diameter spaced at 100-foot square intervals on top of the storage tanks. To avoid excessive interference by wind shadow, a spacing five or ten times blade diameter (or baffle diameter) is considered necessary. The economic viability of a baffle, as compared with a larger rotor, should be determined by separate investigations independent of the storage concept. The results of such investigations on a small scale in the federal program have not yet justified mounting a large-scale demonstration of baffles or downwind "augmenters." In flat country the elevated location atop the tanks is an advantage with or without baffles.

Since the area of the tanks proposed is not great enough for a sufficient array with adequate spacing, a single large windmill of two megawatts or more, such as either of the two now nearing completion in this country, would be preferable. In the system proposed for 1,000 houses and with a 35 percent capacity factor because of the unsteadiness of the wind, this would mean about 700 average watts per house. This is a rather modest contribution but more than that from a few 50-foot-diameter, 50-kilowatt windmills. There is a good British design of a large windmill that was never built, rated at 3.65 megawatts in a strong wind, with a rotatable-tripod tower pivoting on a 142-foot-radius circular track encompassing 1.5 acres.[3] This would fit nicely on the rim of a circular storage tank and make the wind contribution about a kilowatt per house. To increase the wind contribution beyond that, it would probably be most efficient to have a large array of windmills in a remote windy region feeding the power grid and to draw power into the community thermal storage tanks only during periods of high wind and low load on the grid. This would incidentally help with the peak-load problem.

In the federal solar energy program there is too little emphasis on the early deployment of large systems of those energy techniques that are now economically and technically feasible, too much waiting for the next century for them to become important and too little subsidized initiative to make them compete substantially with established fuel-consuming sources in the meantime. Large wind-power arrays in remote windy regions and Engelke's communities with inter-seasonal thermal storage are two such systems that fit together nicely and should be vigorously promoted to make their full contribution soon to our national and ultimately global energy needs.

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University of Massachusetts

1. David R. Inglis, "Power from the Ocean Winds," *Environment* (October, 1978), 17.
2. David R. Inglis, *Wind Power and Other Energy Options*. (Ann Arbor: University of Michigan Press, 1978.)
3. Inglis, *Wind Power*, fig. 12.

Engelke's response: It is a pleasure to respond to Professor Inglis' thoughtful comments on my recent article. In attempting to summarize the cost disadvantages of several alternative energy sources in one introductory sentence, I was indeed unfair to wind power potentialities. The expensive wind power system I had in mind was one including energy storage and using 100 rated kilowatt wind machines for which NASA estimates production unit costs at $1,500 per kilowatt. The larger megawatt scale machines Inglis and most wind power experts favor should cost only one-half to one-quarter as much per rated kilowatt. As Inglis states, a supplementary installation of large-scale machines used without energy storage to replace the burning of fuel oil should already produce an economic saving at the current price of oil. With the added cost reductions made possible by reversible heat pump mechanical energy storage and generation, and artificial hilltop sites, wind power could undersell all other electric power sources except hydroelectric installations.

Unfortunately, because of its brevity and editing of the figure caption, the article conveys two impressions which I did not intend. Firstly, I did not intend to claim that wind machines mounted on the reservoir structure (whose area is only about one acre per 1,000 houses served) could supply the complete electrical needs of the homes served. In a longer paper of which the article is a summary, I estimated that an additional 12.5 acres of solar collector per 1,000 houses served would be required to meet the complete electrical needs with heat engine produced electric power.

Secondly, my original versions of the figure caption included the wording "Linear array of 50-foot diameter wind turbines fed by 100-foot square funnels and spaced at 100-foot intervals." The editor or the draftsman dropped the word *linear* and came up with the phrase "An array of 50-foot diameter wind turbines spaced at 100-foot square intervals", which unfortunately evokes the image of a checkerboard with a turbine filling each square.

The arrangement I intended was a single linear array along a line of perhaps 1,500 feet in length, perpendicular to the prevailing wind direction and rotatable to a limited extent. (A 10-acre reservoir area might be about 1,500 by 300 feet in dimension.) This particular suggested arrangement is an "artist's conception" which occurred to me while making the sketch to illustrate the article, and not an integral part of my proposals. The idea however was to collect as much mechanical energy as possible from the available rectangular area of about 1,500 by 100 feet above the reservoir hilltop, using cheap medium size rotor units not coupled to electric generators, and not having rotation speed controls. The standard practice of spac-

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ing wind machines by at least 5 or 10 times the rotor diameter is based on the different goal of obtaining the maximum possible output from each separate expensive electric generating unit. Inglis' single huge rotor would probably furnish about the same power output as my whole array, at half the cost per kilowatt, but I believe both approaches have a useful role.

I agree completely with Inglis' criticism of the federal alternative energy program's lack of integration, and lack of emphasis on early deployment of economically promising systems based on well-known technology. Inglis points out (in Reference 1) that the federal wind power program has taken six years to arrive in 1978 at the same point which Putnam and Smith reached after two years' work in 1941.

This situation is typical. For example, I and other supporters of community total energy systems exploiting interseasonal thermal storage, have long been urging the Department of Energy to initiate prompt and vigorous study and development of such a system (since July, 1976 in my case). The federal program in this area, as ultimately described to me in a letter I received in December 1977 consisted of two research contracts testing seasonal storage in acquifers and two research contracts testing seasonal storage in constructed tanks. This work will bring us well beyond the point Thomas Jefferson reached in building his 1770 ice house.

However, what cries out for immediate development and testing is some specific, completely integrated community total energy pilot system (the one I outlined or some other) built on a sufficiently large scale to demonstrate the actual performance and costs of an optimum size community system. I should like to emphasize that only commercially available technology need be involved and that such a system promises to cut the cost of utilizing solar and wind energy to a level well below current fossil fuel cost, leading to the willing conservation of the equivalent of several billion barrels of oil per year. The required pilot system investment of about $20 million would seem to be one very suitable use for .2 percent of the Department of Energy's $9 billion annual budget.□

Charles E. Engelke's article in the November 1978 *Bulletin*, "A Self-Contained Community Energy System" really deserves much more prominence than you have given it. The ideas in this article (assuming the calculations to be correct) really amount to a tremendous breakthrough in solar energy.

The system described would enable solar energy to meet all of our space heating needs and probably additional energy needs. The new ideas presented in this article include:

- the use of huge insulated water tanks which make it possible to have interseasonal storage of solar energy;
- the system would meet 100 percent of the heating needs for a community of dwelling places, and would use only half the area per home now being used for limited solar heating;
- the interseasonal storage facilities described in this system make it possible to take *full* advantage of the intermittent and random appearance of both solar and wind energy (which no other system can do);
- in this age of sophisticated research on fusion energy, lasers, and so forth, it is ironic that the great breakthrough results from using a simple principle of mathematics known to any high school math student: namely, that for a sphere, the volume is proportional to the cube of the radius, the area to the square of the radius, and therefore the surface area per unit volume is proportional to the reciprocal of the radius. Hence the bigger the volume, the less the surface area per unit vol-

ume, and the less loss of heat energy per unit volume;

- the system is so efficient that it could not only satisfy all of our space heating needs but also could be used for central station generation of electricity; and thus
- the system could probably be used to generate all of our energy needs.

If such is the case, this is really one of the greatest ideas of the 20th century, and I believe our government ought to start a crash program to implement these systems. Obviously these systems would offer no pollution, either of radioactive wastes or of obnoxious gases and matter from burning fossil fuels. And also obvious is the fact that there is no problem of exhaustion of fuels, since this is completely a solar system (including wind energy as solar energy).

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LNG projects

In the interest of providing up-to-date information on LNG, the following comments on Sidney Wolf's article "Liquified Natural Gas" (*Bulletin*, Dec. 1978) are offered:

Recent events have sharply altered the future of LNG in the United States. Specifically, during the third week of December the Department of Energy killed two LNG projects, El Paso II and Tenneco. These two projects were so large (365 and 397 billion cubic feet per year) that their cancellation dramatically changes the projections on the significance of LNG imports. Contrary to the thrust of Wolf's article, it can now be said that LNG will be a minor source of natural gas supply in the 1980s. Facilities to handle approximately 590 billion cubic feet per year worth of LNG are either in operation or under construction. The only remaining proposal under near-term consideration, the Indonesian-West Coast project, would entail 197 billion cubic feet per year of imports. If the proposal is finally approved, combined LNG imports in the mid-1980s will be 787 billion cubic feet per year (approximately 4 percent of current U.S. natural gas consumption).

Whether or not the recent denials of the El Paso and Tenneco projects constitute a solid anti-LNG policy by the federal government is difficult to say. What can be said is that these decisions were apparently shaped by a number of factors, the most important of which is the increasing evidence of an improved supply and demand forecast for natural gas. In denying the LNG proposals, the Department of Energy argued that natural gas demand in 1985 will be 12 trillion cubic feet per year (compared to current consumption of about 20 trillion cubic feet per year) and domestic sources should easily provide sufficient supplies.[1]

Importantly, most assessments of the current and near-term natural gas requirements attribute the reduced demand to successful energy conservation efforts.[2] Continued progress in natural gas conservation is virtually assured as a result of certain features of the recently adopted National Energy Act: restrictions on utility boiler use of natural gas; adoption of incremental pricing (as recommended by Wolf) in certain cases; and incentives for residential conservation measures.

On the supply side, the agreement on phased de-regulation and natural gas development incentives should spur domestic production, reversing the decline in production cited by Wolf. The final adoption of pricing for U.S. natural gas will also have the effect of facilitating Canadian, Alaskan, and Mexican gas projects.

All of this could provide the basis for denying LNG proposals for some time. The next LNG import project slated for federal consideration (the Indonesian-West Coast proposal), however, entails a somewhat different set of factors. Contrary to Wolf's description of this proposal as an approved project, the West Coast proposal is in the midst of a complicated permit process. At present, the federal government has approved Oxnard, California as the site for the importation of 197 billion cubic feet per year of Indonesian LNG. The State of California, following the legislated mandate for special remote-siting criteria for any LNG facility, has rejected Oxnard but approved Pt. Conception.

The Pt. Conception site, however, handicapped by the discovery of an active earthquake fault, an unresolved conflict with Native American Indian groups, and concerns about the safety and environmental sensitivity of the area, was recently described by the Federal Energy Regulatory Commission as an undesirable site.[3] The result is a likely conflict between state and federal authority over the siting of any West Coast LNG facility.

Presumably the federal decision, expected late winter or spring of 1979, will be decided on the "need" question. That responsibility lies with the Economic Regulatory Administration. It is interesting to note that the Economic Regulatory Administration's denial of the El Paso II project "left the door open for proposals of smaller LNG imports where they are needed."[4] The question of California's natural gas requirements has been central to the LNG debate for some time. Last spring the California Energy Commission argued that future gas needs could be met by a variety of options—a stronger energy conservation and solar promotional program, for example, could displace much or all of the proposed LNG imports. The California Public Utilities Commission, however, rejected the findings of the State Energy Commission and conditionally approved the LNG proposal on the basis of projected needs for natural gas.

In short, the upcoming federal decision on the West Coast LNG proposal will be shaped by many fac-

tors. Regardless of the outcome of that decision, it is clear that at this time the current Department of Energy policy of case-by-case review of LNG proposals will not, as Wolf fears, "turn into automatic project approval." This approach has led to the denial of two large proposals and will enable the somewhat unusual conditions of a third proposal to be given close scrutiny. A more accurate assessment of the situation for LNG would be that an improved supply and demand forecast for the 1980s (made even more credible with the passage of the National Energy Act) has made it possible to make choices between various natural gas supply options, and LNG has now been officially pegged as the least desirable of those options.

Whether or not LNG will return at some future point as a major gas supply option is obviously difficult to determine. In the longer run the fate of LNG will hinge on the success of policies, technologies, and programs to reduce the use of natural gas through energy conservation and various "soft energy" applications such as solar. It is worthwhile emphasizing that the energy end-use for most of the natural gas consumed in this country is for relatively low-temperature applications—precisely the areas where alternatives such as solar (active and passive systems) and waste-heat management are most viable. The policy-level consideration of all large-scale centralized natural gas projects, be they LNG or new large pipeline proposals, would benefit greatly from a more thorough examination of the soft versus hard energy paths.

DONALD K. SCHULTZ
Energy Planner
County of Santa Barbara, Calif.

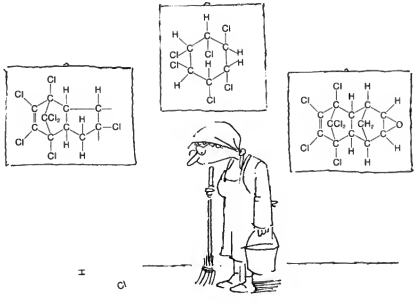
1. Reuters News Service, December 19, 1978.
2. *Oil and Gas Journal*, Sept. 25, 1978, p. 57.
3. Federal Energy Regulatory Commission, Western LNG Project FEIS, October 1978.
4. Los Angeles Times, December 22, 1978, p. 21.

Teaching disarmament and alternative security systems

For college and university teachers who offer or plan to offer such courses, a three-day workshop is to be given at Colgate University, Hamilton, New York, from Sunday, June 24, to Thursday, June 28, 1979. The workshop will provide topics, information, contacts, and source material to help participants organize their own courses in full or in part, meeting with several well-known specialists in plenary sessions and in small groups.

For details on program, speakers, costs, and facilities write to:

Prof. Theodore Herman
Disarmament Conference
Colgate University
Hamilton, New York 13346
(315) 824-1000



World security system

Milton Leitenberg (*Bulletin*, Nov. 1978), quoting with approval Victor Weisskopf's remark "to decrease the level of nuclear bombs . . . is the first and foremost problem of our time," goes on to ask "why should the difficulties of going beyond the two small steps (cessation of bomb tests above ground, and SALT I) be so enormous?

An essential part of the answer is, I think, clear. However illusory and dangerous their quest, nations develop their armaments in a search for security. They will not abandon or slacken this endeavour until they can see some alternative method of obtaining security.

This can only be accomplished through a world security system. At present every nation is seeking a situation in which it is just a little stronger than any potential opponent. While this looks reasonable, indeed essential, from the point of view of any individual nation, no system of arithmetic has yet been devised in which each member of a group is greater than each of the others: hence the arms race and its menacing consequences. It is, however, easy to devise a system in which the whole is greater than any of its parts. In essence this is what has to be done.

The events which led to the formation of the Federation of Atomic Scientists and the foundation of the *Bulletin* also produced the slogan "One World or None." This is even more true today than when it was first

coined and is the reality behind all present day political life. Until this fact is worked out in appropriate political structures we shall remain threatened with total disaster.

The search for security in a world of national nuclear armaments is illusory. So is the search for disarmament in such a world. The key to survival is disarmament, and the key to disarmament is the establishment of an alternative world security system. It is towards the pooling of forces into such a system, with the simultaneous reduction and eventual elimination of national forces, that our endeavours should be directed.

No one can suppose that this is easy, nor that it can be done quickly. For the moment the balance of terror is all we have, and attempting to arrive at some measure of agreement between nations all armed to the teeth is all we can do. It may gain us a little time. But unless these immediate actions are shaped towards the development of a true world security system they are in the long run useless, postponing but not avoiding the ultimate catastrophe.

B. G. WHITMORE
Devon, England

What reactor failures?

Writing in the December 1978 *Bulletin*, R. C. Atkinson states: "Large segments of the public are well aware of the disastrous fallouts from big science and high technology—nuclear reactor failures, oil spills from supertankers, urban blackouts." Oil spills and urban blackouts, yes; but what reactor failures?

The implication of Atkinson's remark is that reactor failures are as familiar and frequent as oil spills and blackouts. Nothing could be farther from the truth. While an incident at an experimental Army reactor did result in three fatalities in 1961, this could hardly be classed as a disaster in the usual meaning of the word. In any case, to date there has never been an accident at a commercial nuclear power plant that has resulted in injury to a member of the general public. Hardly a record of "disastrous reactor failures!"

JOHN R. LAMARSH
American Nuclear Society

Muddled editorials?

My three-year subscription comes up for renewal in February 1979, and regretfully I will not renew it in protest against the muddled and misleading editorials that have been appearing in the *Bulletin* over the last few months. For example, consider the destructive Orwellian piece by your former editor, Sam Day, on "Entebbe." Equally debilitating are "Ode to Diversity," "Recognizing the Enemy" and "Norwegian Prophecy or a Gamble for Peace" by your Editor-in-Chief, Bernard T. Feld, and the Editor's smug response to Martin Eger's poignant and well-documented letter on Russian dissidents and refuseniks (Dec. 1978, p. 47).

I have written Feld on the earlier items but let me just say a few words about the latter. I am shocked that you found it necessary to label all those who wish to sever relations with Soviet scientists as "anti-Soviet zealots." You ignore the fact that all Soviet scientists are servants of the regime and would not be sent on scientific exchanges or meetings if they were not loyal party members and even KGB agents. This party has never had to account for the deaths of millions of innocent people and for those of our colleagues who are today rotting and dying in insane asylums, jails and concentration camps. Of course it's much easier to write rhetorically as you did in the December editorial about "maximum support of the great majority of Soviet scientists who remain committed to the free and open pursuit of peaceful and cooperative scientific ventures in the long-standing Russian and worldwide scientific tradition." Where is the evidence for these grandiose idealizations?

In the meantime, for example, Jews in the Soviet Union are being stopped from publishing, prevented from entering universities, halted from going abroad to scientific conferences (see *Science*: "One U.S. group cancels a Soviet Exchange . . . " Dec. 1978, p. 1066), are being turned into "hewers of wood and drawers of water," and subjected to dehumanizing and vicious anti-Semitism at all levels, reminiscent of Germany in the Thirties. The Russian people (like the Germans) are tragically reaping the whirlwind of these deliberately destructive policies.

Having said all this, I continue to send our publications to many colleagues in the Soviet Union, so that they are informed of our researches, all in the hope that someday a new "thaw" will take place. I met them while I was a guest of the Soviet Academy during 1961 and 1969, when I lectured at Moscow University and other Institutes. Today I am no longer welcome there because of my open stand on behalf of our oppressed colleagues in the Soviet Union (see *Physics Today*, Aug. 1976, p. 13).

Yet again, why does Feld find it necessary to mouth the same orchestrated invective against Israel? He tells us in the December 1978 editorial about "breakdowns of the delicate Egyptian-Israeli negotiations (over an ill-timed announcement of Israeli expansion of settler activities in the occupied West Bank area) that have been occuring with monotonous regularity since Sadat's bold initiative last year." When Jordan occupied the West Bank in 1948, and vandalized and destroyed Jewish Jerusalem, and Egypt the Sinai and the Gaza strip, was that kosher?

As a member of a Canadian delegation to Egypt, Jordan and Israel speaking to many university professors, bureaucrats and politicians this summer, I have found that it is the fundamental nonacceptance of the Jewish people as a nation in the sea of

Islam that is the basic obstacle to peace. Of course petrodollars, oil blackmail and confused liberalism also are not conducive to clear Western thinking or action on these matters, as we are witnessing today. It is always easier to practice surgery on someone else's body.

I. I. GLASS
University of Toronto

Feld's response: I'm sorry you've decided to give up on us. But I don't think that you do our mutual cause justice by the assumption—implicit in your letter—that the only available choice is one between absolute good and unadulterated evil. In my view, this approach involves the equally grave danger of the "self-fulfilling prophecy."□

A high price paid

Victor Weisskopf in his article, "A Peril and a Hope,"* makes a number of very true observations: that we are dealing with cosmic forces in dealing with nuclear energy or that the threat of the "worst reactor accident" is "picayune" compared to the threat of nuclear war."

However, his article contains some contradictions. In one sentence he diagnosed the German people as having been collectively insane during Hitler's rule but failed to explain how at the same time they could have discovered nuclear fission or laid the technical foundation for space flight. He also fails to explain why after the removal of the "cancer of nazism," more than 30 years ago, the world is still threatened by a holocaust which would dwarf Hitler's (or Stalin's) holocaust.

Dr. Weisskopf correctly observes that the patient is sick and that there may be a feeling of collective guilt, not only on the part of the Germans because of Hitler but, because of the atom bomb, on the part of the scientists in general and the nuclear scientists in particular. He fails, however, to identify the cause of the disease, which not only led to Hitler but also to the entire international chaos.

I claim that one of these causes is the concept of the nation-state, which is incompatible with the global reality of nuclear energy. This concept was advanced by Woodrow Wilson under the pseudo-humanitarian banner of "self-determination." One consequence of this policy is that the United Nations today is controlled by a majority of micro-states, some representing just a few thousand people but having the same voting power as the United States. Another consequence of this policy is the establishment of tyrannical governments all over the world, notably in Africa, treating their people worse than any colonial power ever did. Finally, the threat of nuclear proliferation is a direct result of this concept by which in principle every miniature country is given the right to acquire nuclear weapons.

After 1945, the United States, then the only nuclear power, and England, controlling most of the Third World, had the unique historical opportunity to impose a world government. It would have meant confronting Stalin, and since Stalin was a former ally against Hitler the United States seems to have been paralyzed. True, Hitler was a great evil, but so was Stalin and by defeating one evil with the help of another evil—without recognizing this fact—a high price was paid.

Just think, how nice the world could be under a world government. For example, people in Europe could freely communicate in a great cultural exchange never possible in former times without today's means of transportation and communication. In the Near East, Arabs and Jews could settle freely and peacefully wherever they pleased and there would be no Idi Amin. Mankind as a whole could work together toward the goals of defeating all diseases, conquering space and establishing research colonies on the Moon and Mars. It is tragic that the trend toward unifying the world was reversed after World War I.

F. WINTERBERG
Reno, Nevada

*Victor Weisskopf, "A Peril and a Hope," *Bulletin*, 35:1 (January 1979), 10-13.

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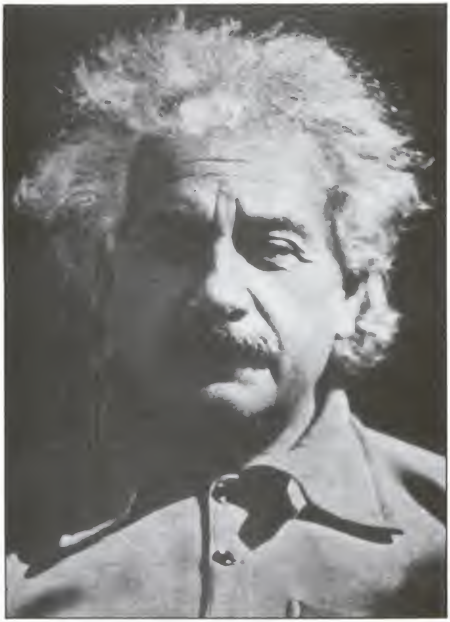
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Einstein and Peace

March 1979 marked the 100th anniversary of the birth of Albert Einstein, a founding sponsor of the *Bulletin*. To commemorate the event, the Bulletin published a special issue in his honor. The contributors are: Bernard T. Feld, Harrison Brown, Glenn Seaborg, Joseph Rotblat, M. A. Markov, Hannes Alfven, Margaret Gowing, Spencer Weart, Alva Myrdal, Toshiyuki Toyoda as well as recollections by Eugene Rabinowitch, James Franck, Leo Szilard and Robert Oppenheimer.



Single copies of this special issue are available: $3 plus 75 cents U.S. postage; $2 overseas airmail. Orders should be accompanied by U.S. check or international postal money order. Bulk orders on request.

"The real ailment seems to me to lie in the belief that we must in peacetime so organize our whole life and work that in the event of war we would be sure of victory. This attitude gives rise to the belief that one's freedom and indeed one's existence are threatened by powerful enemies." —Albert Einstein on "Symptoms of Cultural Decay," *Bulletin*, October 1952.

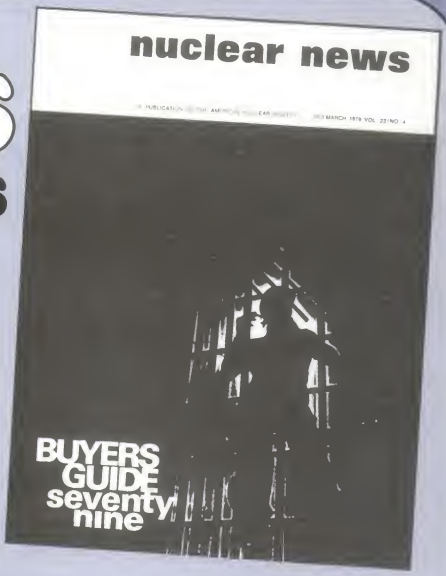
"Even now, some 40 years later, the importance of Einstein's role in the American achievement of nuclear weapons before the end of the war against Japan, remains a source of legitimate controversy." —Bernard Feld in "Einstein and the Politics of Nuclear Weapons."

"From the first time I heard him speak, I could only think of his deep concern for humanity. In this respect, his face—and particularly his eyes—were fully as eloquent as his words."—Harrison Brown in "An Early Brief Encounter."

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